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Turbine Blades in the Making

By Fred H. Colvin

Editor, *American Machinist*

Some of the methods and operations in forging, machining and assembling the blades of steam turbines —Special milling fixtures and inspection gages

FEW of us who see steam turbines in operation have much of an idea of the large amount of engineering, tool designing, machining, inspection and general grief that can be tied up in such a comparatively small space. And most of the aforementioned factors are due to the turbine blades and not to the case or housing itself, even though the latter has a few problems all its own.

In the beginning of turbine construction the blades were a comparatively simple problem, being cut off from drawn sections and requiring but little machining. Further development of the turbine, however, has brought ever increasing demands for greater economy of steam consumption as well as greater mechanical reliability, with the result that many blades are drop forged of difficult sections, and with a constantly changing contour, as can be seen from some of the illustrations that follow. Some of the blades run up to 28 in. or more in length, increasing not only the possibility of distortion in heat treating, but making it almost a certainty in an appreciable percentage of the products.

Many of the reaction blades are still made of bronze of drawn sections that are comparatively simple, from a manufacturing viewpoint. Even these, however, have a few problems that will be discussed later, but the most interesting part of the work from the mechanical side is that of making the forged-steel blades for the rotor.

The progressive steps in the manufacture of a low-pressure blade are indicated in Fig. 1. Beginning with the round blank shown at the left, the blade is drawn out under the Bradley helve hammer shown in Fig. 2 until it resembles the long spindle shown as the next stage. Fig. 2 shows the motor driven hammer, the shape of the break-down dies, some of the forged blades in the steel barrow used for transportation, and part of the oil furnace used for heating. Here the roughed-out blanks go to the furnaces and to the heavy, board drop-hammer shown in Fig. 3, where they are forged to shape. The finished blade has such thin edges that it is only possible to strike the blank two or three blows before it must be reheated. To maintain the required accuracy of the dies, necessitates frequent dressing which adds materially to the cost of the die upkeep. A study of Fig. 6, showing a corner of the die room, gives a good idea of the amount of equipment necessary to maintain the dies in good working order. Special stands are provided, each having a portable grinding outfit mounted on a swinging arm, so as to make it easy to reach any part of the die either on new work, or in refinishing dies after they have become worn in service. The other items in Fig. 1 show the blade after being forged and trimmed, and, at the extreme right, after being machined ready for assembly in the rotor.

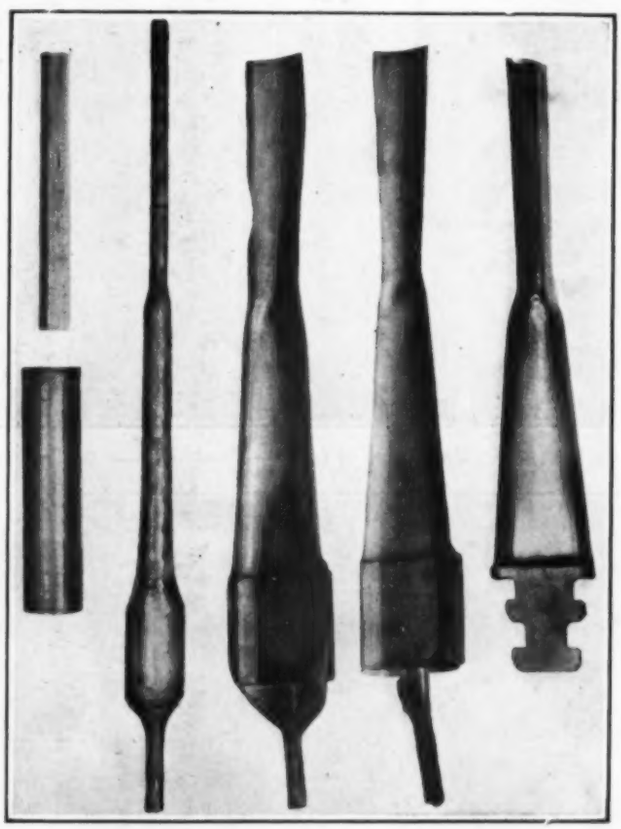
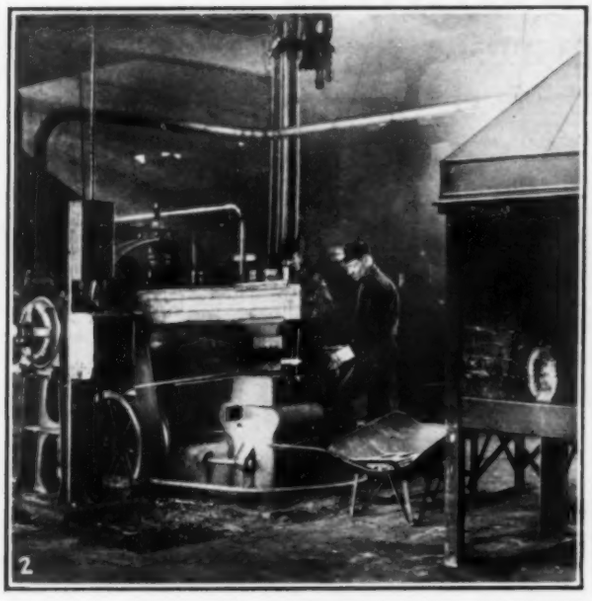


Fig. 1—Steps in forging a rotor blade

Some of the dies themselves are shown in Figs. 4 and 5. These views give a good idea of their shape and construction as well as their size. The tolerances on the forgings are held to within a few thousandths,



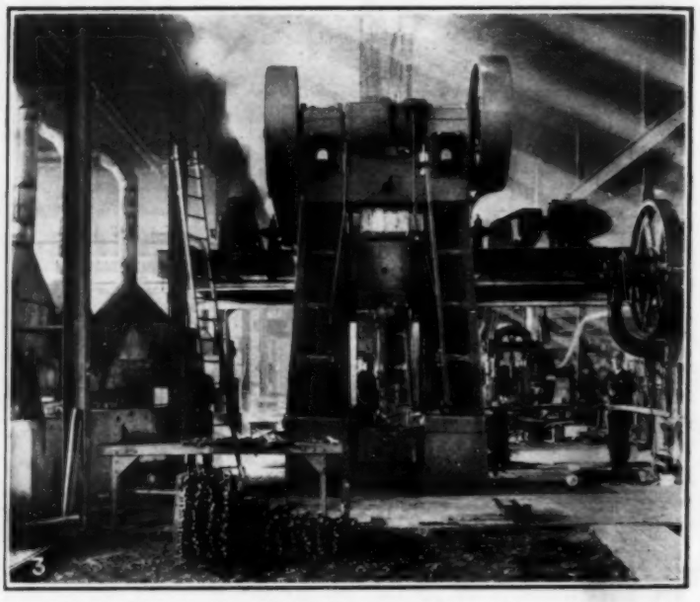


Fig. 2—Breaking down the blanks. Fig. 3—The large drop-hammers used

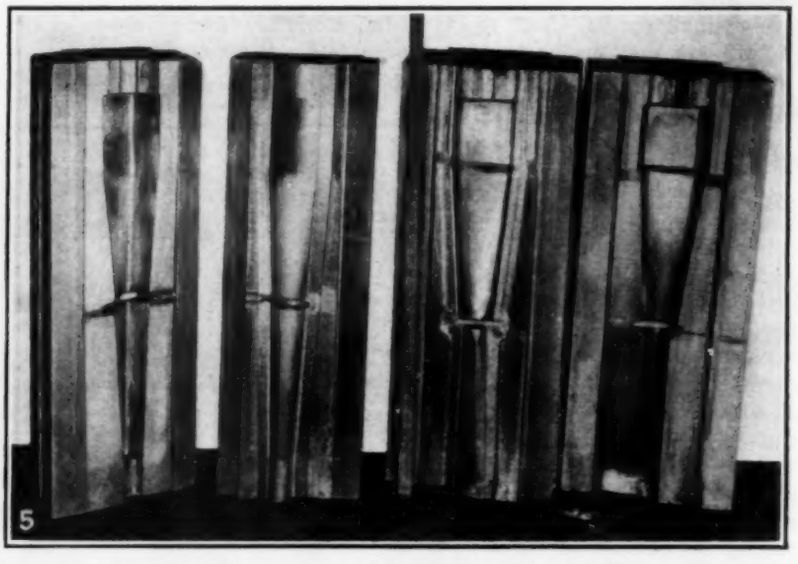
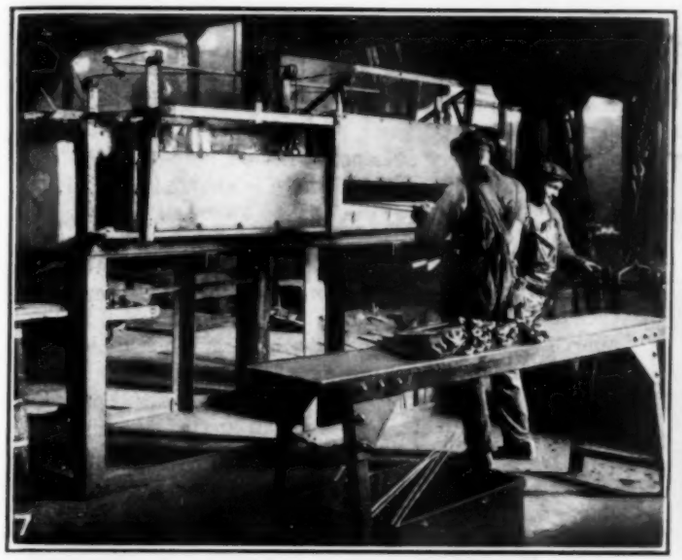


Fig. 4—One of the lower dies in place. Fig. 5—Showing size and construction of dies

Fig. 6—A corner of the die-making shop



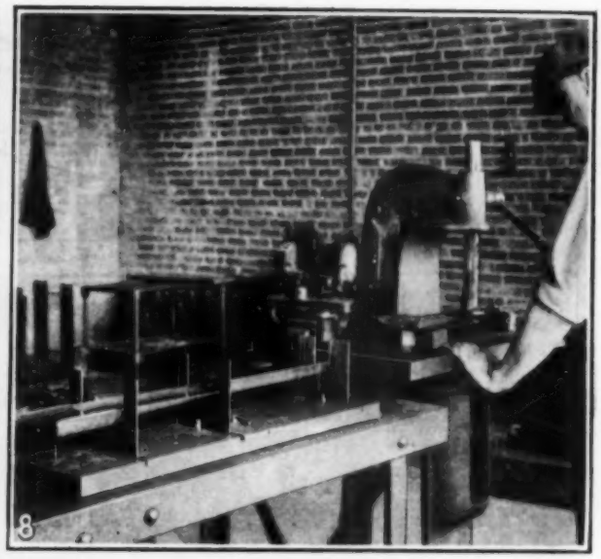
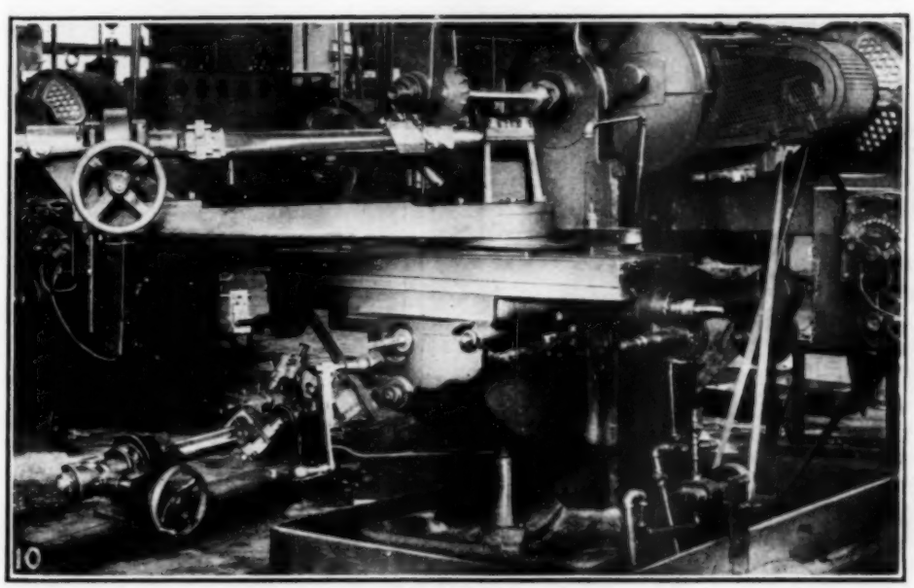


Fig. 7—Heat-treating the blade. Fig. 8—Correcting distortion

Fig. 9—Where the blades are milled



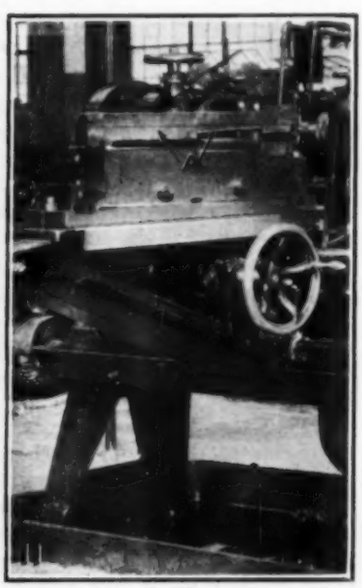


Fig. 10—Radius milling fixture. Fig 11—Milling base of blade

being very close for work of this size and kind. The material is a 5 per cent nickel-steel. After forging and trimming, the blades are treated in the furnaces shown in Fig. 7, and then quenched in oil.

Before going to the machining department, the blades are inspected for contour and straightness in the gage shown in Fig. 8. The uprights can be moved to different positions along the baseplate and locked by cam-operated clamps. When correction to the blades is

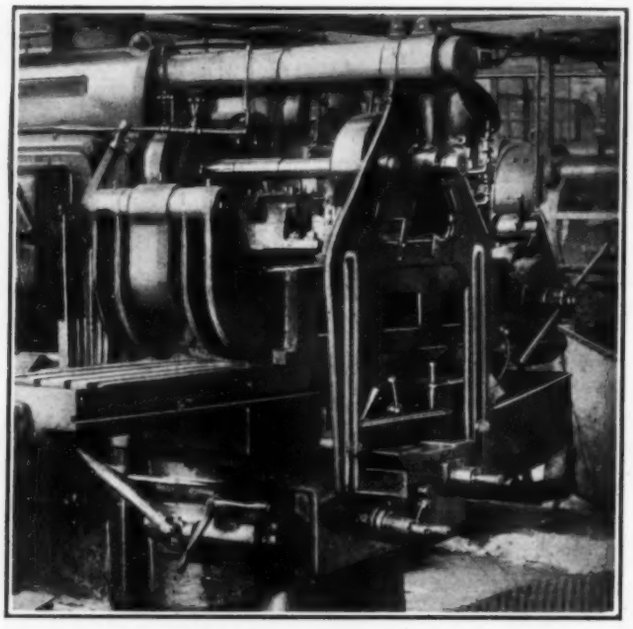


Fig. 12—A large bridge-milling fixture

necessary, it is accomplished by the small arbor press shown at the right.

A general view of the section of the machine shop where the blades are milled is shown in Fig. 9. This view also gives an excellent idea of the shop construction, and the way in which electric wires are brought to the various machines. Individual-motor drive is universal and the arrangement of wiring shown is high enough to be out of the way and is considered more desirable than cutting up the floor for conduits and plates that are not as conveniently reached in case of necessity.

One of the important milling operations on the blades is shown in Fig. 10, where a large fixture is used in milling the thin edge on the top of a large blade. The illustration shows how the blade is clamped to the fixture, how it is revolved under the milling cutter by the handwheel-operated worm at the left, and how the whole fixture can be swung on its center bearing to secure the desired angle or curve at the end of the blade. Incidentally, the illustration shows how the driving motor is mounted on a steel extension-bracket, bolted to the column of the machine. On the floor may be seen another milling fixture for a different type of blade, showing the cam at the left by which the bar carrying the work is advanced as the blade is rotated by means of the worm gearing.

A milling operation on the base of a blade is shown in Fig. 11. Upon close examination it will be seen that the blade is held at an angle and is very carefully supported in the fixture at *A*. The two edges on opposite sides of the blade are milled simultaneously on the duplex machine shown. The fixture has four bearing points so as to locate the blade properly and hold it firmly in the correct position, but without springing it or allowing deflection while the cut is being taken. It should be remembered that this blade is approximately 30 in. long and of very thin section, excepting at the base where it is being milled.

A large bridge-milling fixture is shown in Fig. 12, the whole central part of the fixture swinging on the crossbar shown, so as to mill the proper radius on the base of the blades where they are fastened in the rotor. The shaft carrying the swinging fixture has a bearing at each end, while the fixture itself is controlled by suitable mechanism at the opposite end, operated by the pilot wheel at the extreme right.

It will also be noted that the milling cutter is not on the machine spindle, but is on an auxiliary spindle considerably below it, being driven through gearing. The fixtures described give some idea of the special tooling that is necessary to handle this work satisfactorily. The problem of shop overhead that is presented can be better appreciated when it is realized that changes of design are not infrequent and that the number of turbines fitted with blades of any one design seldom runs into large figures, owing to the rapid and continuous advances made in the turbine art.

One of the final inspection gages is shown in Fig. 13, and its construction indicates how the same body or frame can be used for different blades. The thin gaging plates of about $\frac{1}{8}$-in. steel, are inserted at various points in the body and show any discrepancies in the contour at the various points.

Another gage, this time for the bases of the blades, and to show how the different parts fit together, is illustrated in Fig. 14. These parts are stationary or reaction blades, as can be seen from the fact that they

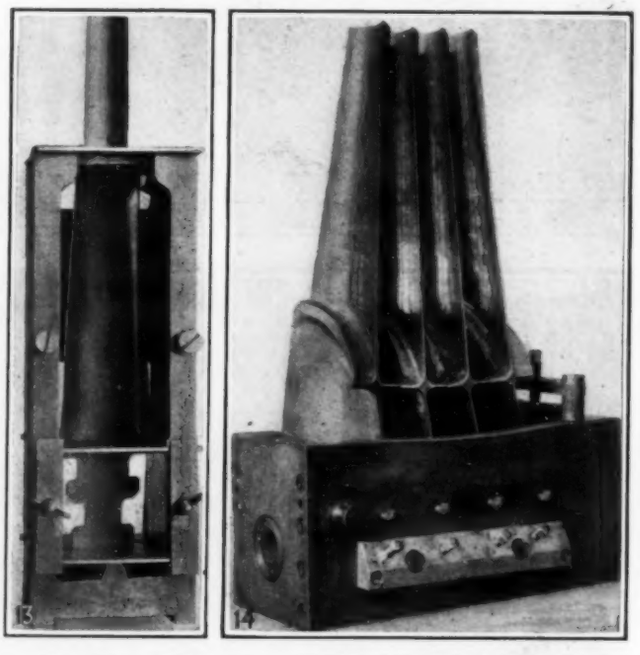


Fig. 13—Contour gage. Fig. 14—Testing blades together

are thicker at the bases and taper toward the small ends. When the various curves and shapes are considered, it is easy to see why tolerances must be kept small, as an accumulation of errors in the same direction would easily multiply into rather large proportions and seriously affect assembly.

Think of Your Scrap in Terms of Productive Labor

By L. C. Morrow
Managing Editor, *American Machinist*

Causes for rejections — Re-operation work — Added responsibility for foremen—Recapitulation of results obtained by proper direction of supervision and labor

SPECIAL reports are sometimes necessary to indicate certain faults that are contributing unduly to scrap, for example the "Rust Expense" report, shown in Fig. 6. Only a little rust is required to disqualify a ball bearing and the prevention of rust requires constant vigilance. When bearings are disassembled all rivets and cages become scrap, and of course rusted parts are scrapped. The relative importance of rust as a scrap producer is evident, and a special report is a necessity. Again the cost of the scrap is figured in its proportion to productive wages.

With the exception of the rust-expense form the reports referred to have dealt with work in process. It

Rust Expense
1924 and 1925

1924	Disassembling Bearings	Work in Process	Rings in Storeroom	Total	% to Productive Wages
Jan.					
Feb.					
Total					
1925 Jan.					

Fig. 6—A special report, the function of which is apparent

is that kind of work that requires first and constant attention, that faulty parts may not get into the assembly department.

Despite close tolerances and careful inspection of work in process, not all of the assembled bearings will be passed by the final inspection. The "whys" of rejection are a final check that has an effect back through the assembly, inspecting and machining departments, all the way to the material. Reports of the final inspection department reveal a multitude of faults that are tackled for correction in order of their size. There are two reports, made on the forms shown in Figs. 7 and 8, one made weekly to show the bearings rejected by final inspection and sent to the disassembling department, and the other made monthly to give a comparative analysis of the rejections by the final inspection departments. On both reports it is necessary to show cause for rejection.

The many opportunities for going wrong in making the ball bearings and the immense value of the reports as checks upon the entire manufacturing process are indicated by the following list of causes for rejection:

Bore large	Chattered groove
Defective cages	Nicked groove
Cage high	Inner race side
Rough	Inner race groove
Nicked groove	Inner race eccentricity
Inner race side	Lands large
Inner race groove	Fit—loose or tight
Inner race eccentricity	Small O. D.
Fit—loose or tight	Width
Small O. D.	Outer race eccentricity
Width	Outer race side
Outer race eccentricity	Ball missing or bad
Outer race side	Radius
Ball missing or bad	Rust
Rust expense	Out of round
Defective rivet	Defective rivet
Appearance O. D.	Appearance O. D.
Appearance bore	Appearance bore
Scrap bore	Defective material
Bad dust caps	Tight cage
Loose cages	Scrap bore
Outer race groove	Rusty cage
Bore small	Groove out of center
Stamped on wrong side	Bad dust cap
Appearance outer race side	Loose cages
Appearance inner race side	Incorrectly matched
Bore large	Large O. D.
Defective cage	Outer race groove
Cage high	Nicked filler slots
Rough	Taper bore

Certain purposes, as served by the monthly comparative scrap report shown in Fig. 1, have been enumerated. A further function of these monthly reports is to afford comparisons throughout the year. To simplify using the information necessary for comparison the monthly scrap report shown in Fig. 9 is prepared. The form provides for carrying along the totals of preceding months. This report is made for standard products only. It will be noticed that entries made are the ratios of scrap loss to productive labor.

Re-operation work is performed by indirect labor and becomes a part of the overhead. But overhead as well as direct charges must be kept low, and because re-operation work is caused directly by scrap, an analysis by departments is made monthly and becomes one of the scrap reports. The form is shown in Fig. 10. The ratio of the cost of re-operation to the cost of productive labor is given.

Just as a machine pays the greatest dividends when it is kept running continuously, so the operator on productive labor is most valuable when he is on pro-

Conclusion. The first part was published on page 41.

ductive work 100 per cent of the time. Special efforts are made to keep his equipment in order, stock at his machine, his tools and gages in repair. All of his time off of his productive job is charged as non-productive work. That is done for two reasons, to be fair in the productive labor charge and to keep before the eyes of supervision the losses due to and the causes of non-productive work. Reports are made monthly, by department, the charges being set against causes. Even under very careful supervision the necessity for non-productive work occurs, as is illustrated by the following lists of items against which charges for non-productive work were placed during a year. The lists cover the cage, forging, machining and grinding departments:

Cleaning
Scrap
Putting tools away
Unpacking steel
Miscellaneous
Trucking
Repairing machinery
" tools
Cleaning machinery
Experimental work
Welfare
Shop orders
Waiting for tool repair
" " belt "
Inspecting
Cleaning steel
Lighting furnace
Waiting for power
" " air
Repairing machinery
" tools
Shop orders
Waiting for work
" " tools
" " water
Repair railroad siding
Cleaning motors
Loading cars
Waiting for tool repairs
Re-erecting equipment
Trucking
Learning
Instructing
Helping
Repairing machinery
" tools
Waiting for work
" " tools
" " machine repair
" " tool "
" " belt "
" " gage "
" " power "
" " water "
" " c'ntersh'ft repair
Waiting for set-up
" " inspection
Cleaning machinery
Straightening steel
Experimental work
Oiling machinery
Shop orders
Repairing motors
" f'nit're and fixt'res
Welfare
Assisting foreman
Repairing equipment
Learning
Instructing
Work in oil
Wiping
Disassembling
Cleaning machinery
Waiting for work
" " tools
" " machine repair
" " tool "
" " belt "
" " gage "
" " c'ntersh'ft repair
" " power
" " water
" " air
" " set-up
" " inspection
Repairing machinery
" tools
Mounting wheels
Greasing
Cleaning
Learning
Experimental work
Washing-machine operator
Trucking
Shop orders
Cleaning tanks
Inspecting
Welfare
Assisting foreman
Cleaning benches

Records may be kept and reports made and though their value as deterrents is admitted, scrap losses will remain high unless the information to be gleaned from the reports is analyzed and acted upon. To illustrate this point:

Some time back it was noticed that certain reasons for scrapping parts were constantly repeated, and the quantities of parts scrapped were out of all proportion to what they should have been. Investigation showed that some rings contained burs, so that when several rings were placed on an arbor for outside-diameter grinding, and pulled together, distortion took place. Further investigation showed that the burs were raised when the rings were thrown together in carriers for trucking. That work was done by the truckers. Two steps were taken as remedies: A new type of trucking rack was put into service and the trucking jobs were reserved for one type of labor—the man over 45, just fussy enough to see that his rings are treated carefully. It was found that dirt, picked up from the trucks, caused scrap, and the frequent cleaning of trucks with coal oil was inaugurated.

Another recurring cause of scrap was given as "new men," and the report was found to be correct. There

Bearings Rejected by Final Inspection and Sent to Disassembling Department

Week Ending----------

Bearing No.	Quantity Inspected	Quantity Rejected	% to Total	Bearing No.	Quantity Inspected	Quantity Rejected	% Total

Code	Quantity Inspected	Quantity Rejected	% to Total
Totals			
Thrust			
Totals			
This Week			
Last Week			

Cause	Rejections	% to Total
Totals		

Totals _____
Thrust _____
Totals _____
This Week _____
This Month to Date _____
Last Month at This Date _____

Fig. 7—A check upon the entire manufacturing process

were two things to do: reduce the number of new men, and increase the instruction. Both steps have been taken, the first by work of broader scope in the employment department and the second by relieving the foremen of the duties of teaching. The instruction of new men is now under the time-study department, and inasmuch as the men of that department are skilled operators, it is probable that the quality of the instruction has been improved. At any rate the foremen now find it possible to give their entire time to supervision.

Comparative Analysis of Rejections Final Inspection Department

Cause	January		February	
	Quantity	% to Total	Quantity	% to Total
Totals				

Fig. 8—A check by comparison

With this change, more responsibility for scrap losses was placed on the foremen, and the results have proved that the plan was a wise one. To this change much of the reduction in scrap is attributed. It is a change that, accompanied by a simple system of scheduling and routing, has taken out of the shop the hustle and bustle contributory to wasteful work.

The employment department has taken on increased importance in the campaign to reduce scrap. The department now keeps a record for each man of efficiency, scrappage, absenteeism and lateness. It does the hiring and has the final word in firing. It is a department

that can, and does, discuss with the employees questions of adjustments in pay, personal records and so on, things that once occupied the time of the foremen. There is a contact that is very beneficial to both sides.

After the shortcomings of management, such as described, are corrected, the changes do not seem to have been many or of magnitude. That is quite likely to be true when improvements are made in any well-run business because the simple change that is to have far-reaching results is often difficult to visualize.

Here, by way of recapitulation, is a list of the things that were done at the Hess-Bright plant, not with materials and equipment, but with supervision and labor:

Round-table meetings of the department heads were inaugurated and by them the foremen, who are directly responsible for scrap, are reached by the head of the plant.

Through the activities of the foremen, as a direct result of the round-table meetings, the man in the shop is brought into contact with the manager's problems and requirements.

The influence of non-productive labor has been established and its reduction and control undertaken.

The duties of hiring and instructing new employees have been taken from the foremen, leaving them all of their time for supervision.

The duties of the employment department have been increased, and by that increase closer contact between the shop workers and the management has been secured and labor turn-over has been reduced.

An analysis of this recapitulation shows that a less extensive list will also cover the program of the Hess-Bright company as it bears upon scrap reduction. It consists of three items:

The organization and education of all of those in authority and responsibie for scrap, so that causes of scrap may be definitely determined.

The bringing about of proper co-operation between the factory organization and the accounting organization.

The presentation of the whole subject of scrap to the men on the machines in a manner that will permit of the problems being thoroughly understood.

Organization of individuals of the factory into a group that will function successfully in the prevention of scrap is not easy, even though it may appear to be so. Typing the line-up and sending notices to the men concerned is not enough. Before these men can teach the men on the machines about the costliness of scrap, they themselves must be taught. They must have a clear picture of the losses in spoiled pieces.

Scrap Report for Month of _____

Standard Products Only

Dept. No.	Prod. Labor	Value of Scrap Loss	Ratio Scrap Loss to Prod. Labor												Summary This Year to Date			
			This Month	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Month	Prod. Labor	Scrap	%
																Jan.			
																Feb.			
																Mar.			
																Apr			
																May			
																June			
Total Machining																July			
																Aug.			
																Sept.			
																Oct.			
																Nov.			
																Dec.			
																Totals			
Total																			
Total Grinding																			
Grand Total																			

Fig. 9—A continuous comparison of scrap

It should go without saying that the text book for the education of the factory organization must come from the accounting organization. To be able to furnish a good text, the cost system must be properly planned and efficiently operated. There is little hope of accomplishing any reduction in scrap without that. Granted a cost system such as described, there still is little hope unless there exists the second of the three items, proper co-operation between the factory organization and the accounting organization. To secure genuine co-operation is an extremely difficult accomplishment. In some plants there is none whatever. Perhaps there is a sound explanation for the natural antipathy for the accountant that seems to exist in the factory. If so, there is a chance for universal correction. Until corrected, too much scrap will be made.

Telling the Story of Scrap to the Men on the Machines

With the factory organization educated against scrap, and with co-operation between factory and accounting organization established, there remains the third item, the presentation of the whole subject of scrap to the men on the machines.

The average operator, when thinking of a scrap piece, insofar as he may be concerned, tends to consider only

Statement of Re-Operated Work
For the Month of_____

Dept. No.	Dept Name	Pieces Paid for	Pieces Not Paid for	Total Pieces	This Month		Last Month	
					Cost of Re-Oper.	% to Prod. Labor	Cost of Re-Oper.	% to Prod. Labor

Fig. 10—The report of re-operation work is a check on overhead charges due to indirect labor

the piece rate for his operation as having scrap value, because that is the amount he loses. It is quite necessary to have him thoroughly understand that the scrap value of the piece is the cost of the material plus the cost of all previous operations plus the cost of departmental overhead on each operation. It is necessary, therefore, for the foremen to show to the operators the figures representing the money value of the parts scrapped.

Sometimes the story of scrap can be shown graphically, along the lines followed at the Hess-Bright plant some years ago. Here is the story as told by an official of the plant:

"We were shipping out a car load of scrap rings, which, to be sure, was an accumulation over a long period, and contained rings from the rough-forging state up to finished ground parts. We had a photograph taken of this car of scrap parts and figured approximately the cost value of those parts as compared with the scrap value. The picture and cost figures were used to very good advantage throughout the factory by having them brought to the attention of the workmen as well as the foremen and heads of departments. In order to make the subject more impressive, any suggestion or discussion of the time for accumulation of the amount of scrap in question was entirely eliminated."

In conclusion, a few words concerning forms. Some plants are overburdened by them, others have none. It is better to have none, if the information on them is not used. The collection, analysis and presentation of the information are expensive, and no matter how beautiful the forms and how complete the analysis, they themselves are just another form of waste so long as the scrap continues to pile up. To quote again from the Hess-Bright official, "Our experience has shown that the cost of preparation and accumulation of this material is paid for several thousand times by the amount of scrap reduction."

Vacations for Wage Earners

Although annual vacations with pay have been considered as the prerogative of the salaried employee, some of the wage earning employees this year will go on vacation, with pay, under experimental arrangements inaugurated by a number of industrial companies who believe that regular vacations will prove valuable in preserving the health and morale of the workers.

While the average period of service of the wage earner heretofore has been considered as being too short and uncertain to warrant vacations, those concerns experimenting with the innovation, according to a survey made by the National Industrial Conference Board, are inclined to consider vacations with pay as an incentive for the worker to stay on the job, and, thus, as a means to reduce labor-turnover. According to the investigation some thirty concerns are trying the system.

A variation of the vacation-with-pay plan is what is described as the "contributory plan," under which the employer grants a vacation to such workers as are willing to save up a certain amount of money toward it, in which case the company contributes to the cost of the vacation granted. Under both, the contributory and non-contributory schemes, merit systems are usually applied, under which a vacation is conditioned on records of attendance and performance.

Vacations without pay are the rule in industries which are able to shut down for a certain time during the slack period of the year, and who utilize that time for repairs and a general overhauling of the plant. A few, however, are trying out the plan of paying the employees' wages during the time of such shut-down.

Use of Check Nuts—Discussion

By H. K. Pinkerton

The question and answer concerning check nuts on page 328, Vol. 62 of the *American Machinist*, recalls an experience of mine.

I came to the conclusion that as long as a whole nut and a half nut are used on the same bolt the half nut is just an ornament if it is put on last. If locking is secured, and we will define locking so that there is no misunderstanding, the last nut put on does all the holding.

Locking means (to me) that the slack in the threads of the first nut is opposite that of the threads of the second or top nut.

To put a nut over another nut where locking does not occur is just kidding oneself into thinking he has done something to prevent the two nuts from coming off. We have no quarrel with those who want to ornament their bolts and studs thus, but if the object is to prevent loosening, the last nut put on does the holding and it is obvious that the thicker nut is the logical one for this important place.

Fixture for Indexing the Teeth of Elliptic Gears

By Jack Williams

Based on the principle of the ellipsograph—Adaptable to different ratios of ellipse—Necessary to change but one part to cut different ellipses

THE illustration Fig. 1, shows a fixture designed by the engineers of the New Britain Machine Co., for cutting the teeth of the elliptic gears used on the various machines built by that company, to operate the geneva stop motion, indexing the turrets. These gears are made to different sizes and pitches as well as of varying degrees of ratio between the major and minor axes. Though there are three fixtures, differing somewhat in constructional details, each fixture serves to cut several sizes and ratios of gears. The device is based upon the well-know principles of the ellipsograph, that the sum of any two radii taken from the respective focal points of an ellipse and meeting at the perimeter is equal to that of any other two radii taken in the same

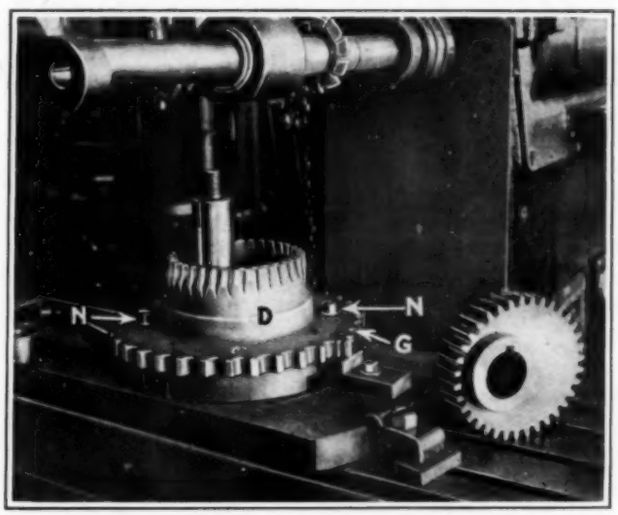


Fig. 1—Device to cut elliptic gears

manner. The ratio of the ellipse to be cut by the device is determined by the amount of eccentricity given to the shoulders of an interchangeable stud—called the "stump"—that is screwed to the baseplate of the fixture.

The principle of the ellipsograph is illustrated graphically in Fig. 2, where two rollers fixed in the triangle may be moved about in the crossed slots of the base, causing the stylus at the apex of the triangle to traverse the perimeter of a true ellipse, the ratio of which is determined by the fixed distance *X Y* and the amplitude by the height of the triangle. In the device under discussion, the rollers of the above illustration are represented in the fixture by the eccentric shoulders of the stump while the crossed slots are in the underface.

The fixture is used on a standard milling machine, attached by the baseplate with suitable clamps. It is not necessarily ribbed to fit the T-slot in the work table as its exact location is not material. When the fixture is once adjusted with reference to the cutter on the arbor of the machine, the traverse and cross movements of the table are locked and are not disturbed during the progress of the operation.

The stump, shown in Fig. 3 is a three-shouldered stud, made in one piece, the larger diameter *A* of which is recessed into the baseplate and held by fillister-head screws; the upper face of the shoulder being flush with the surface of the baseplate. The middle shoulder *B* is shown offset with relation to the shoulder *A*, but the amount of this offset does not affect the ratio of the ellipse; it is merely to keep the latter within bounds. If the difference between the major and minor axes of the gear to be cut is large, the amount of offset would be relatively great, while if the gear were nearly round the shoulder *B* could be centrally disposed.

It is the amount of offset given to should *C* with relation to *B*, that determines the ratio of the ellipse, and this eccentricity may be of any amount desired (within the limits of the device), as the gear to be cut departs more or less from a true circle. It is essential that the small shoulder *C* shall lie wholly within the circle of shoulder *B*, in order that the device may be assembled; otherwise *B* and *C* might be of equal diameter.

The underface of the rotatable member, marked *D* in Figs. 1 and 4, is bisected at right angles by two slots crossing at the center. One of these slots is about twice the depth of the other so that the keys *E* and *F*, Fig. 4, may slide endwise in their respective slots without interference. The lower key *E* has a large hole midway of its length to fit the shoulder *B* of the stump, while the shoulder *C* of that part fits a corresponding hole in the upper key *F*, as shown by the sectional drawing. The upper key is made to fill the full depth of the slot, but it has a clearance hole at the center where it spans the lower key.

The index plate *G* is made as a separate piece, bolted and dowelled to part *D*, so that it may be removed and another plate having a different number of notches substituted for it. Part *I* is also separate from part *G*, to which it bolted and dowelled, but this a matter of convenience in construction rather than necessity. Parts *D*, *G* and *I* are truly circular and concentric. The stud *J* is provided with a spline for locating the work and with a slip-washer and nut for holding it down firmly on the rim of part *I*, that sustains the pressure of the cut.

The shoulder at the lower end of the stud is a light drive fit in part *I*, located by a Woodruff key and held by a nut as shown. The stud appears considerably off center with relation to part *I*, but this is to accommodate a gear that is bored correspondingly off center, and has no connection with the ratio of the ellipse.

It is essential to have the perimeter of the gear blanks so located that it overlaps the entire supporting member. The location of the stud *J* may be changed with reference to the center of the supporting member in order to accommodate gears of varying degrees of eccentricity. The gears to be cut have a hub upon one face and are always handled in pairs; the plane surfaces being placed together with the hub of the lower gear entering the cored space in the supporting member. The diameter of this cored space is made large enough to accommodate the hubs of the various gears. The slide-block *K* is ribbed to fit a longitudinal T-slot in the baseplate of the fixture and carries a stud for locating the index.

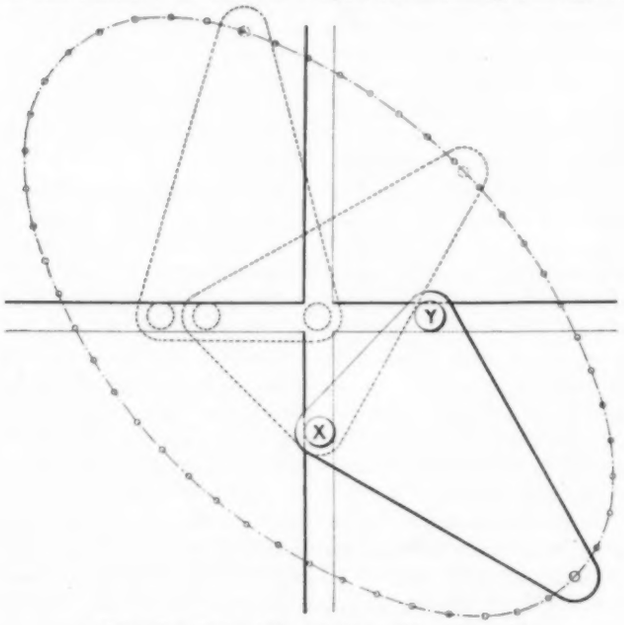


Fig. 2—Principle of the ellipsograph

This stud is round and the notches in the plate are semi-circular to match, for reasons that will be apparent as the action of the device is studied. When setting up the machine it is essential to locate the center of the locking-pin in precise vertical plant (widthwise) with the central plane of the cutter. The position of the slide-block to and from the center of the device will vary with each notch.

Clamping the Fixture

As the entire rotatable member floats about on the baseplate, being guided in its apparently erratic path by the sliding keys on the respective shoulders of the stump, it becomes something of a problem to provide an easily and quickly manipulated means of clamping while the cut is in progress. The problem is worked out as shown in Fig. 5, which represents a section taken at an angle of 45 deg. from that in Fig. 4. In the baseplate a circular T-slot surrounds the stump and is concentric with its large diameter. In this slot slides a block,

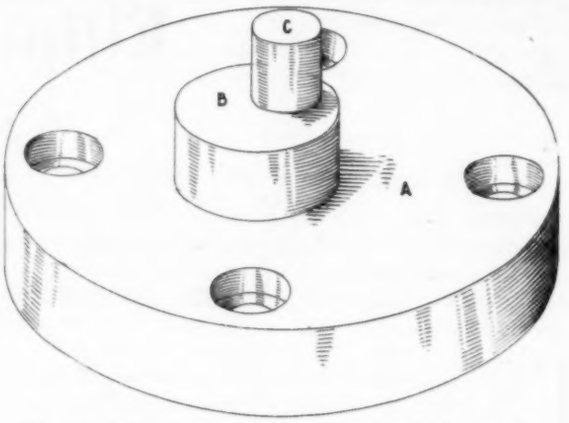


Fig. 3—The "stump"; the heart of the device

tapped for the fillister head screw *L* that passes loosely through the end of the short lever *M*, which in turn is located in a cored pocket in the underface of the rotatable member. In the opposite end of the lever *M* is a button *N*, of hardened steel, while midway of its length the lever is tapped to receive the collar-head screw, extending through a clearance hole in the casting. The collar of this screw is made long enough to pass through another clearance hole in the index plate, so that the latter may be removed without removing the clamp screw. There are two of these clamps used, and in Fig. 1, the letters *NN* indicate their location. By tightening the screws, the button *N* is drawn against the casting and the block in the T-slot is caused to bind against the shoulder of the slot. The reason for this somewhat roundabout method of clamping will be understood when we consider that the movement of the rotatable member is never concentric with the T-slot and that its path varies with different gears. The variation is compensated for by the lever swinging about in the cored pocket, occupying any position from tangency to radial with respect to the circular T-slot.

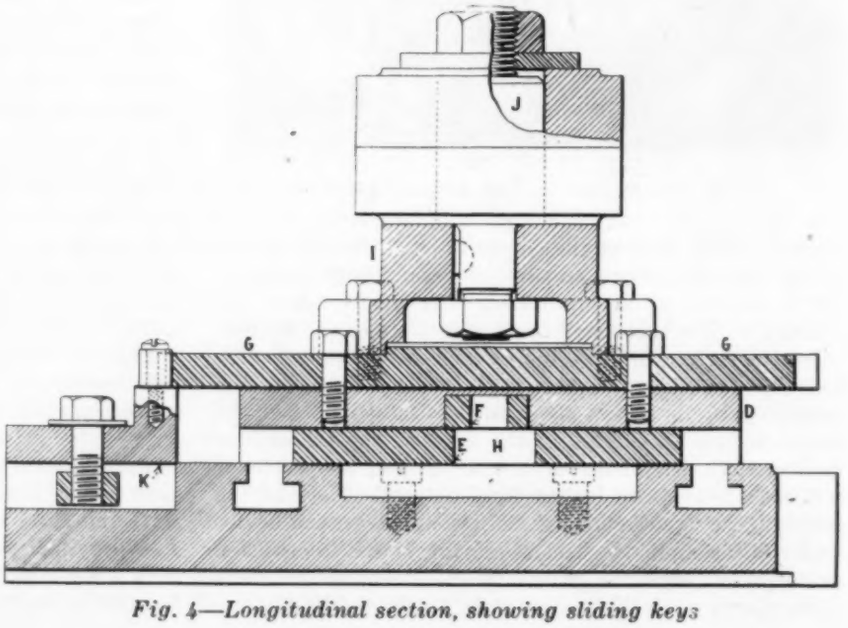


Fig. 4—Longitudinal section, showing sliding keys

It will be seen that in swinging about its elliptical path, the actual center of the rotatable member can coincide with the longitudinal center line of the fixture only in the two positions when the major axis of the gear to be cut parallels that line; and teeth may or may not be required at these points. Therefore, except in these two possible positions, the index plate is never

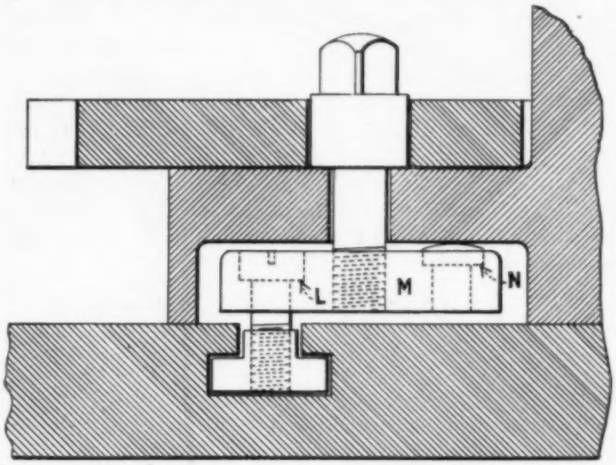


Fig. 5—Section at 45 deg., showing clamping device

presented squarely to its pin. It is for this reason that the pin is made round and the notches semi-circular, so that no matter how far to one side of the center the rotatable member may swing, a full and correct engagement is assured, that could not be the case with any other shape of notch and pin. When the pin is moved back to permit the member to be indexed and is brought into engagement with the succeeding notch, it cannot occupy the same position lengthwise of the baseplate as before. The perimeter of the gear blank, being elliptical, remains in the same plane with relation to the cutter but the index plate, being round does not.

Recommended Practice for the Heat-Treatment of Plain Carbon and Alloy Spring Steel*

GENERAL—This recommended practice covers the process to be followed in the manufacture and heat treatment of springs, such as medium and large coil, and flat leaf springs.

Approximate Chemical Composition

Steel	C	Mn	P	S	Si	Cr	V	Mo
C.....	0.90–1.05	0.30–0.50	0.040	0.050	0.10–0.25	.....	.....	.....
Cr.....	0.45–0.55	0.80–1.00	0.040	0.050	0.10–0.20	1.00–1.20	.....	.....
CrV.....	0.45–0.55	0.70–0.90	0.040	0.050	0.10–0.20	1.00–1.20	0.15–0.25	.....
CrMo.....	0.45–0.55	0.70–0.90	0.040	0.050	0.10–0.20	0.70–0.90	.....	0.20–0.30
CrSiMn....	0.45–0.55	0.70–0.90	0.040	0.050	0.40–0.60	0.70–0.90	.....	.....
SiMn.....	0.55–0.65	0.70–0.90	0.045	0.050	1.80–2.10	.....	.....	.....

*This is a tentative Recommended Practice approved by the Recommended Practice Committee of the A. S. S. T., and will remain tentative until such time as it is adopted by the Recommended Practice Committee and the Board of Directors of the Society. The Committee was composed of four users and three manufacturers as follows: Users, W. H. Phillips, chairman, Du-Ray Smith, C. G. Shontz, H. G. Peebles; Manufacturers, J. W. Weltzenkorn, E. C. Smith, and Elmer Larned.

SPRING STEELS AND THEIR CHEMICAL COMPOSITION—The steels listed below are those most commonly used by the spring manufacturers:

HARDNESS OF STEEL AS RECEIVED FROM MANUFACTURER—(a) The maximum hardness limit of leaf spring steel will depend to a considerable extent upon the nature of any cold work to be performed upon it. A maximum Brinell hardness number of 321 is satisfactory for the thinner gages (less than $\frac{1}{8}$ in.) where only the simple cold working operations such as shearing, punching, and trimming are necessary. Heavier gages ($\frac{1}{8}$-in. or over) should have a maximum Brinell hardness number of 302. A minimum hardness limit is necessary only in special cases.

(b) All coil spring bars $\frac{1}{2}$-in. and under should be soft enough to permit shearing without breaking. Larger sizes should be purchased cut to the proper lengths.

FORGING, FORMING, AND COILING—The lowest temperature at which the steel will work satisfactorily should be used. This temperature should not exceed 1,850 deg. F. and the steel should be held at this temperature for only sufficient time to thoroughly soak through.

The method of cooling after forging or forming is usually not important. When severe coiling or other severe forming operations are performed, the steel should be allowed to cool in the air until it becomes black.

HEAT TREATMENT OF SPRING STEEL

Normalizing—The steel is normalized when considerable machining is required, when severe cold working is to be done, or when the product has been subjected to localized heating at several places for the purpose of forging. The normalizing temperatures are given in the following table:

Heat Treatments for Leaf and Coil Springs

Steel	Normalizing Temperature Deg. F.	Hardening Temperature Deg. F.	Approximate Tempering Temperature† Deg. F.	Brinell Hardness Number
C.....	1,575–1,625	1525	600–950	352–415
Cr.....	1,600–1,650	1525	650–950	363–444
CrV.....	1,600–1,675	1,550–1,600	675–975	363–444
CrMo.....	1,600–1,675	1,550–1,600	675–975	363–444
CrSiMn....	1,600–1,650	1,600–1,650	675–975	363–444
SiMn.....	1,600–1,650	1,600–1,650	650–950	363–444

† The tempering temperatures are to be used only as a guide in obtaining the Brinell hardness numbers given in the table.

Hardening—The steel should be heated uniformly to the temperature shown in the table and quenched in oil. The time, in minutes, of heating in the furnace may be determined approximately by multiplying the diameter of thickness of the steel in inches by 60.

Tempering—The steel should be heated in a suitable tempering medium to the temperature shown in the table. It should be held at this temperature for sufficient time to permit complete penetration of the heat. The method of cooling after tempering is optional.

HARDNESS TESTING ON FINISHED PRODUCT—The Brinell test is widely used on flat leaf springs, and when specified should conform to the limits shown in the table.

Hardness tests on helical springs may be made by the Brinell, Rockwell, or scleroscope tests. When the Brinell is specified, it should conform to the limits shown in the table.

Progress—in Five-Year Jumps

By John R. Godfrey

OLD man Johnson took a trip not long ago and one of the shops he visited filled him plumb full of ideas—on how not to run a business. Not that he's blaming the individual, but he says the system is all wrong.

Just for the sake of a name we'll call the machines made in the shop referred to centrifugal pumps, principally because they're not. But the similarity is near enough to hang the tale on—so here goes:

"You know Godfrey," he said, "it fair made me weep to see the money that's tied up in jigs and tools for making a few parts. The pumps, you know Godfrey, have been figured down to the tenth part of a cat's eyebrow, and the engineers count angles and curves in hundredths, the same as a miser does pennies.

"Although there's only a few builders, they seem to have a gentleman's agreement to cut each others' throats at every opportunity. The result is that every time a new buyer sticks his head up, they all jump for him like the 'barkers' in front of an east-side clothing store. They promise to build him a pump that will fit his case 'like paper on the wall,' as the aforesaid barkers say about their clothes. The only difference is that the east siders are wiser—they sell what they have, while the pump builders try to make their products fit by building a new pump for every customer. Sounds fishy, I know, but that's what they told me themselves—they rarely build over one or two from the same patterns and they change the angle or curve of the runners a part of a degree to let the customer know he's getting the last word in pumps.

Progress Confused with Change

"Talk about overhead, Godfrey, they haven't got anything but. Special tools and fixtures that would sink a battleship piled all over the place. Patterns that cost oodles of money are used once or twice and either tucked away in the hope of using them again sometime—with modifications of course—or being scrapped. In the first case they take up storage space and increase the fire hazard, and in the second, the loss is due at once. In either case 'old man overhead' gets his.

"Progress, Godfrey, like charity, covers a multitude of sins. We might quote the old boy who said 'liberty, what crimes are committed in thy name,' just before he got the axe, and use 'progress' instead. That's the only alibi they have for spending hundreds of thousands of dollars for new patterns, tools and fixtures.

"The trouble is, Godfrey, too many mix up 'progress' and 'change' and use 'em interchangeably, but I'm derned if I believe they should be. I've seen too many cases where men made changes and hollered about their being improvements, only to find that they didn't make and better products, or any more money than before. And sometimes they even went back to the old way of doing things.

"Just suppose we changed the design of our motors every six months, to please some customer or because we thought piston rings a hundredth of an inch narrower or wider would be better! We'd be in a fine mess in no time and costs would go skyhigh—as they have in the pump shop I visited. Good machine equipment, good tools and good men, but they can't overcome the handicap of constant changes.

"Progress—real progress—means the getting of things that give better *net* results to all concerned in the long run. And I don't believe this pump game is doing it. Even if every change were a little improvement—and it wouldn't be human if they all were—I don't believe it pays to make 'em so often. If I was running the plant I'd try to do something after this fashion:

"I'd say to my engineers, you've done a good job in bringing the efficiency of these pumps to the present figure. Keep right on figuring and experimenting and researching as before, we want the best—always.

"But, Mr. Engineer, don't go fussing in the shop with your new ideas 'till I give the word. Unless you, or some other engineer performs a miracle, *we won't change our present design for five years.* When the five years are up, we'll go through the grief of new designs if it's worth while, and then we'll stick to them another five years, or thereabouts.

A Substantial Saving Promised

"Perhaps you think I couldn't sell 'em Godfrey. Well by thunder I'm betting I could. If we didn't change the design for five years, we could give the cost of manufacture such a wallop that our prices would interest Mr. Consumer as much as a half of one per cent economy. Those big pumps run up in to real money, Godfrey, a hundred thousand dollars a crack, and more. Now if I could save a man twenty-five thousand a pump, and I could, and he tucked that away in good 'six per cents,' he'd not only have his money but an income that would offset quite a little increase in efficiency.

"Of course, I know I'd be howled at as a back number and an enemy to progress. But when you get a machine with efficiencies up in the ninety per cents, it costs a lot of money for each additional per cent you save. I'm as keen on conserving natural resources by saving fuel as the average man. But fuel isn't the only item to consider. And I'll bet the net savings to the country would be more if we made five-year jumps in cases of this kind than where we change designs with every order, and keep the cost of building machines at a ridiculously high point.

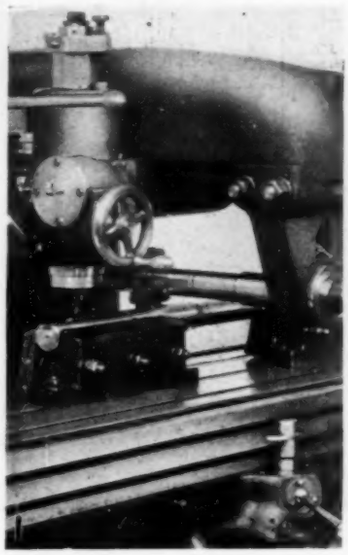
"I happen to know that the Pump company isn't making a dollar on those big pumps. If I was a stockholder, I'd raise the roof at the next meeting even if they called the police. The management hasn't anything to lose except some pride or prestige, or something else that don't pay dividends, and a lot to gain by having backbone enough to insist on building standard pumps for a few days, at least.

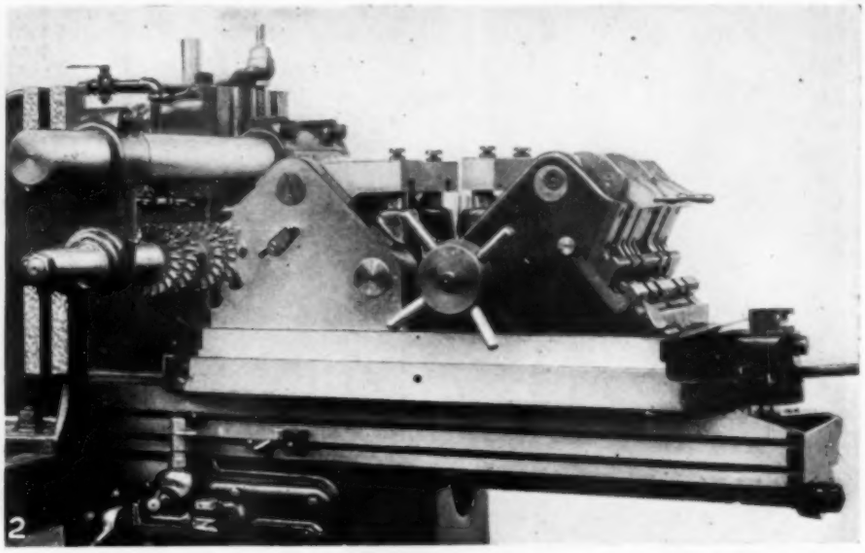
"Think it over, Godfrey, and if you don't agree, just point out why."

I'm still thinking.

Works-Council Plan Growing in Industry

Although we hear very little about the Works Council in industry at present, the idea is growing steadily according to data furnished by the National Industrial Conference Board. The first works council in this country is said to have been held by the Nernst Lamp Co. in Pittsburgh, in 1904. In 1919 there were 225 councils in operation, 725 in 1922 and 814 in 1924. The number of employees represented has increased from 391,400 in 1919 to 1,177,037 in 1924.





Four Modern Milling Jobs

Photographs by courtesy of the Cincinnati Milling Machine Co.

CUTTING a keyway with a regular face cutter and rounding the end with a second cutter at the same setting, is accomplished by the method shown in Fig. 1. The vertical spindle is in a housing on the overarm and has a vertical movement, to keep it out of the way while the keyway is being cut, and to allow it to be brought down after the face cutter has been raised out of the work. The vertical quill is moved by the handwheel shown. The vertical spindle runs 3.2 times as fast as the horizontal spindle.

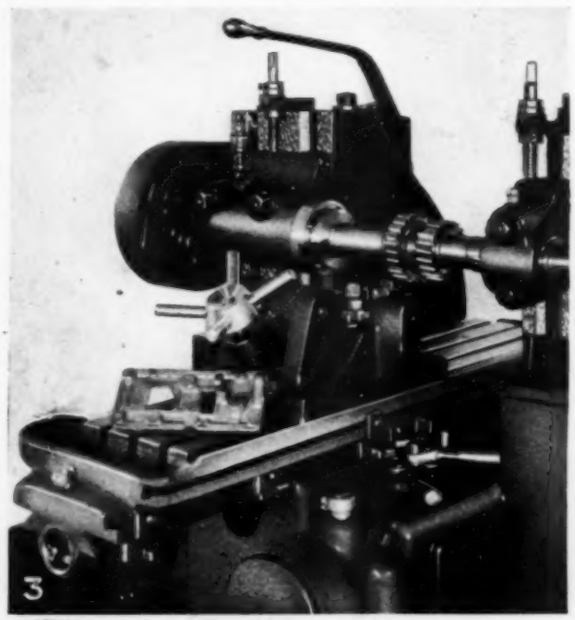
Door-hinge straps are milled in the fixture shown in Fig. 2 on an automatic milling machine. Four hinges are held in each row and the rows or decks are so placed, one above the other, that one cutter will mill two pieces. The pieces are located sideways by fixed stops and held by individual clamps. The cut is $\frac{1}{2}$ in. wide, with a feed of $1\frac{5}{8}$ in. per minute.

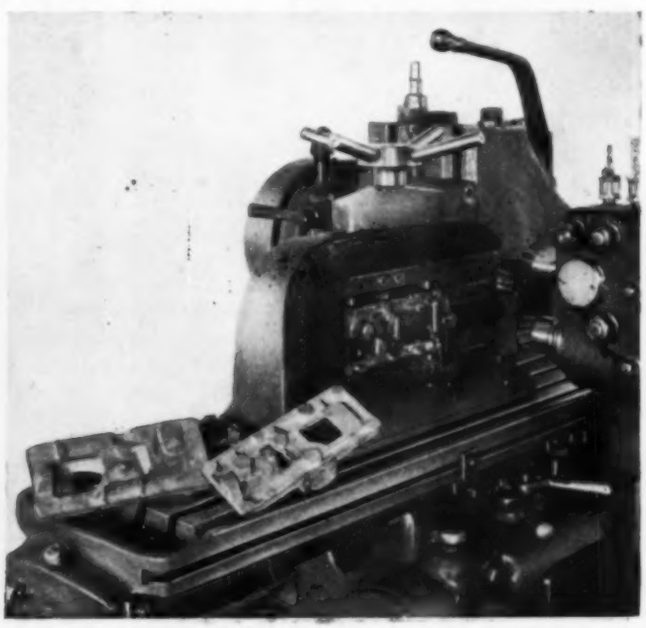
In Fig. 3 is a simple fixture for milling a frame of cast iron in a plain automatic miller. The work rests on bosses and one spring-plunger support. The cutters are of stellite and run about 135 ft. per min. with a feed of 12.8 in. per min. The time per piece is 0.5 minute.

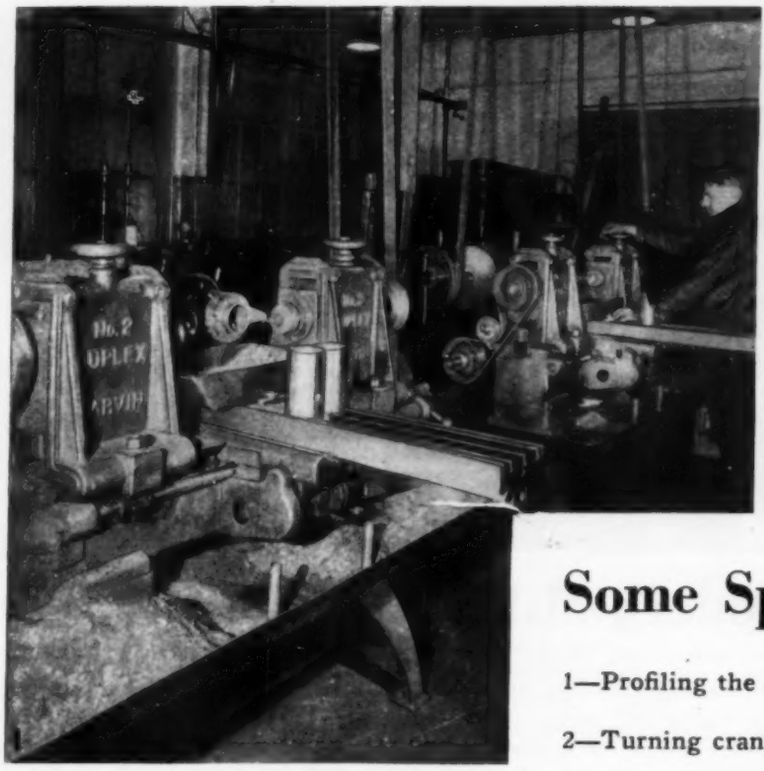
Another operation on the same piece is seen in Fig. 4. The work passes between two sets of cutters, three in all, and finishes the piece on both sides at one pass.

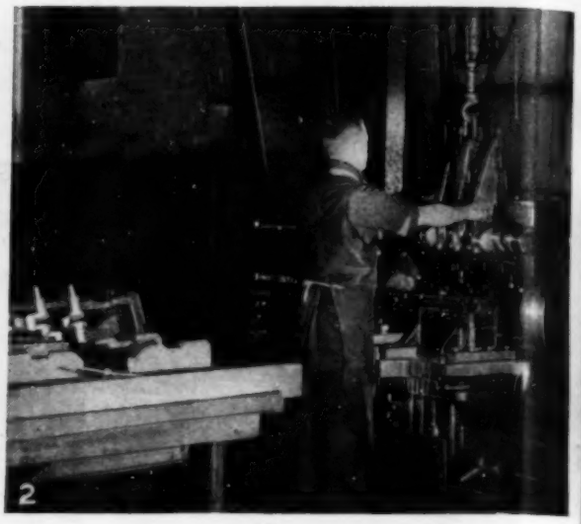
The work rests on its edge on two fixed supports, is located sideways by three fixed stops, and endwise by the fixed stop shown at the right. The cutters mill the bottoms and two rows of bosses on the opposite side.

The cutting speed is about the same as that given for the operation shown in Fig. 3, the feed being 22.6 in. per min. The time per piece is 0.48 minute.









Some Special Methods Used in A

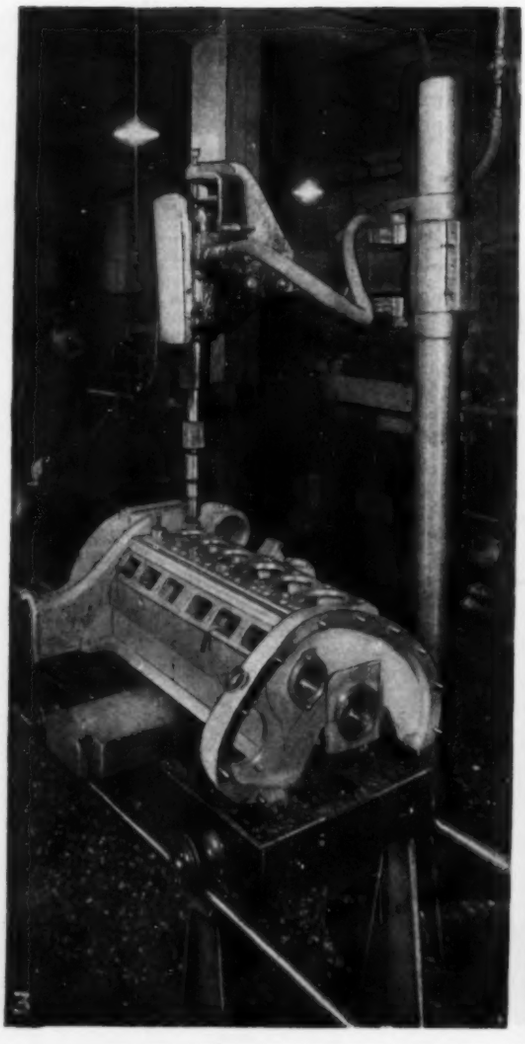
1—Profiling the elongated piston skirt

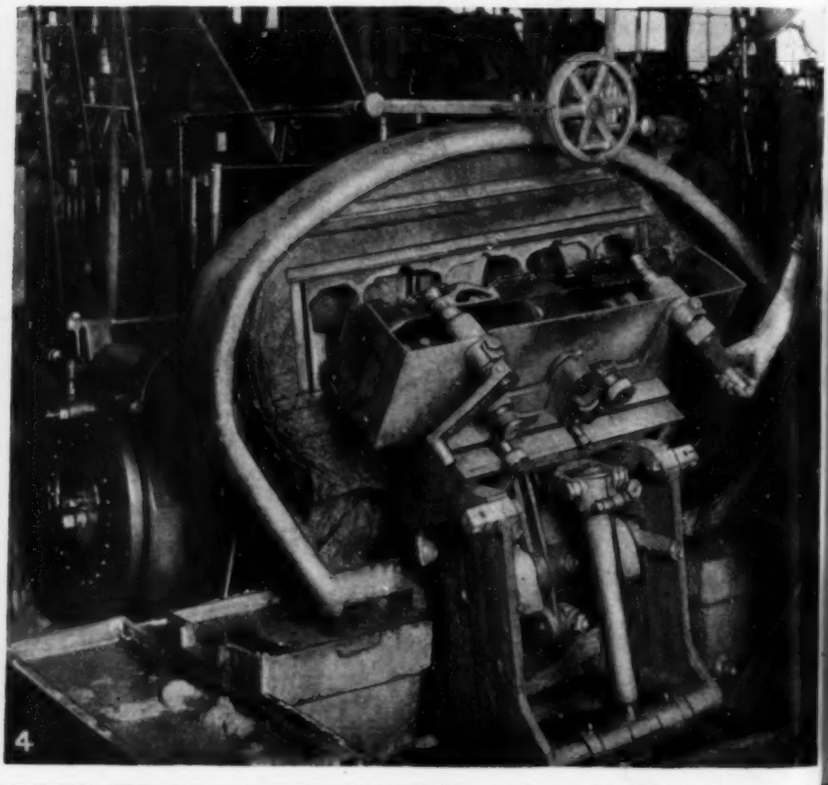
2—Turning crankshafts on Lodge & Shipley lathe

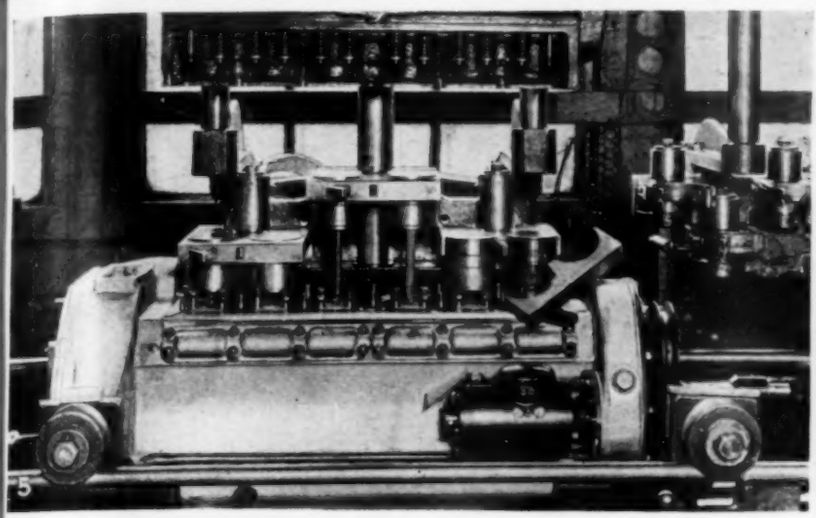
3—Studding crankcases, using an Apex tapping device and a special fixture

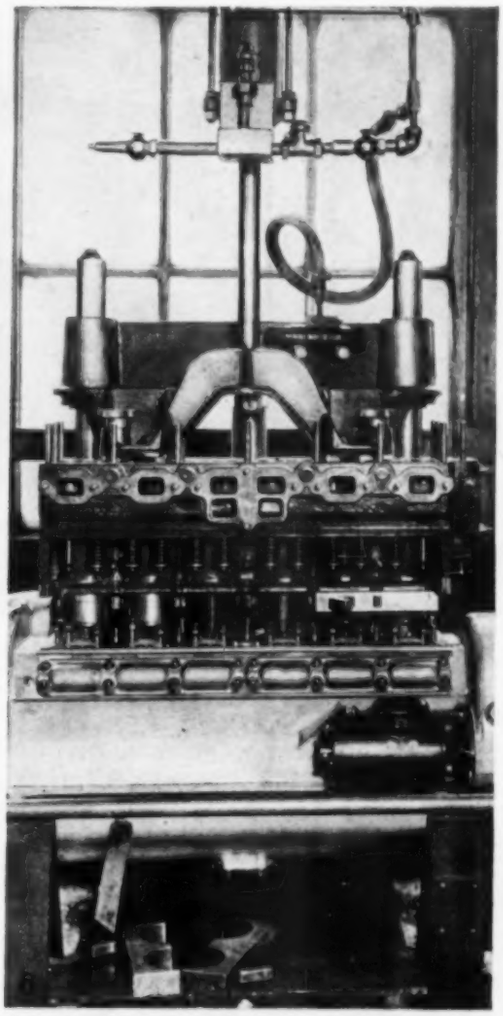
4—Grinding manifolds in an Osterholm machine. Note quick-acting cam fixture

Photographs by courtesy of the Packa









in Assembling Packard Engines

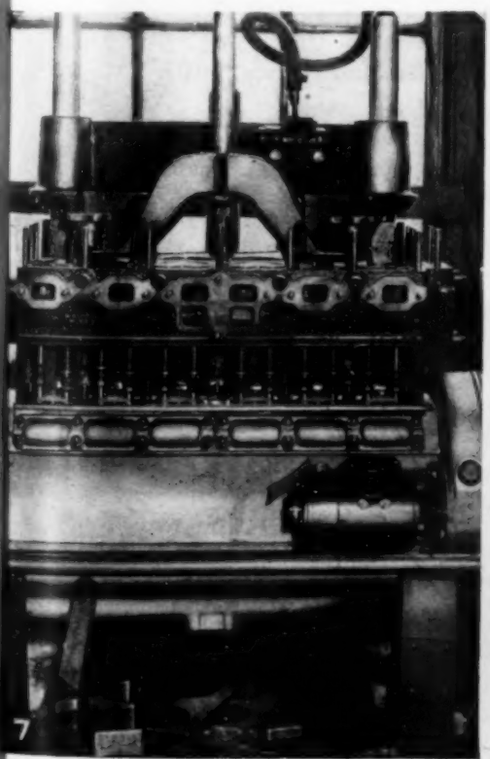
5—Special air-operated fixture for engine assembly. Note method of compressing piston rings

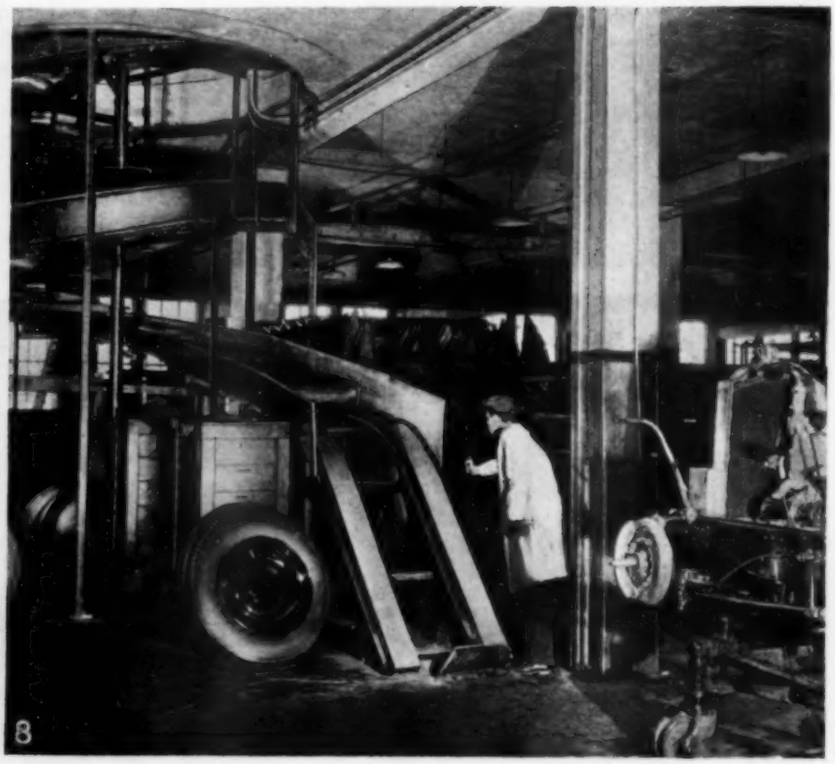
6—The assembling operation under way. Note pistons at the left

7—Cylinder block in place

8—Bringing wheels with tires to chassis assembling

of the Packard Motor Car Company





Where Boys Learn Practical Shop Work

1—The foundry and cupola

2—In the forge shop

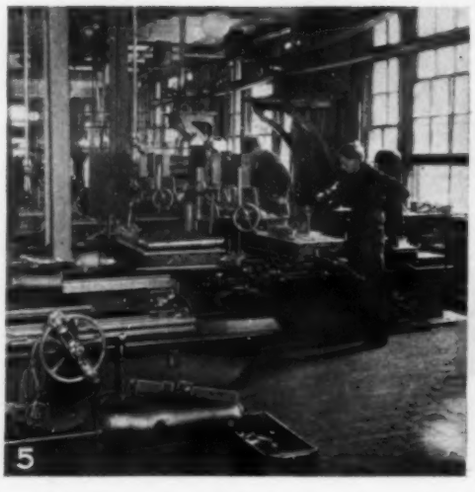
3—Engine and turret lathes

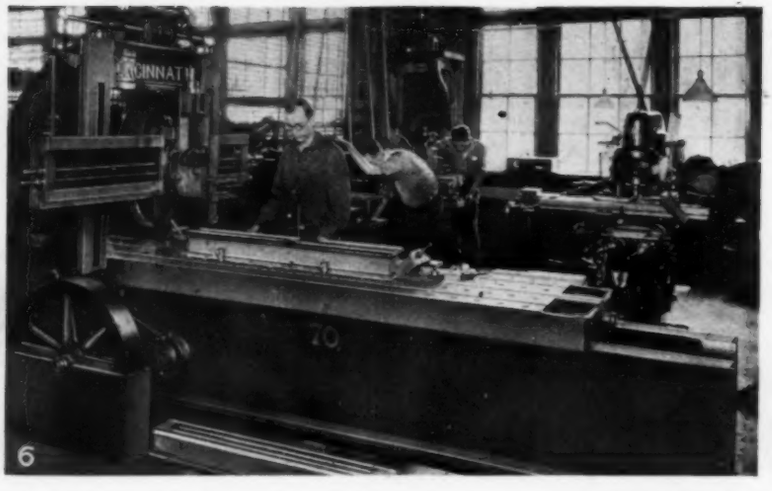
4—Where tools are made

5—Grinding and boring machines

6—Planer, shapers and vertical miller

Photographs by courtesy of the Wentworth Institute, Boston, Mass.





Repairing Locomotive Frames by Arc Welding

By James M. Vossler
Welding Supervisor, Southern Pacific Lines, Houston, Texas

Melting filler rod to form correct bead—Necessity of cleaning work—Preparing frames for welding—Use of double V-type cut—Laying beads in line with the strain

ARC welding is a form of autogenous welding wherein an electric arc is used to produce the heat that melts the filler rod, also preparing the surface of the work to receive the molten metal from the filler rod. This form of welding is divided in two classes, namely, the carbon arc and the metallic arc. In the first mentioned, a carbon electrode is used, the negative line from the d.c. generator being connected to the carbon electrode and the positive to the body of metal on which the welding operation is to be performed. After the arc has been established, between the carbon electrode and the piece to be worked, the metal to be added is fed in the arc stream in much the same manner as in acetylene welding.

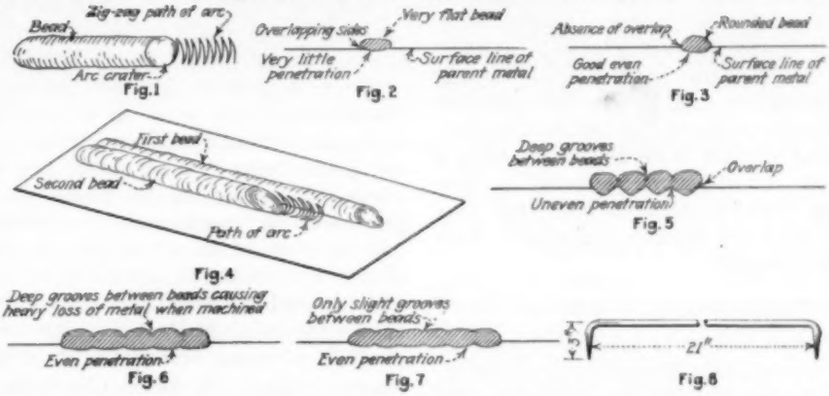


Fig. 1—Method of carrying arc. Fig. 2—Overlapping of the bead. Fig. 3—Absence of overlap. Fig. 4—Depositing additional beads. Fig. 5—Bead made by carrying arc in straight line. Fig. 6—Bead made without climbing of arc. Fig. 7—Correct form of bead. Fig. 8—Tram used for laying out work

The metallic arc process, the one to which this article is devoted, differs from the above in that the filler rod performs the double function of manipulated electrode and filler rod. For general welding, on low-carbon steel and iron, the polarity arrangement is the same, but for special work such as thin plates, high-carbon steels and alloy steels, the polarity is reversed.

In establishing the metallic arc, the electrode is quickly struck against the work and as quickly withdrawn to about $\frac{1}{8}$ in. This having been accomplished, the arc, as soon as the crater or molten spot on the work forms, is carried forward with a zigzag motion, as shown in Fig. 1 in the direction that the bead, or row of deposited metal, is to be formed. Care should be taken that the arc length is maintained at $\frac{1}{8}$ in. or less, the shorter the better. The object of the zigzag motion is to melt the entire surface of the work to contract with the bead, thus eliminating all chances of the edges of the bead overlapping the parent metal and not being welded thereto. Overlap is indicated by the bulging appearance of the side of the bead, as shown in Fig. 2, while the absence of overlap is indicated by the sides of the bead rising from the parent metal and curving over to the top of the bead as shown in Fig. 3. The melting action of the work extends down from $\frac{1}{16}$ to $\frac{1}{8}$ in. below the surface plane of the work, and is commonly termed penetration. The portion of the work that is melted becomes thoroughly mixed with the deposited metal by the action of the arc, making possible a better union than is generally obtained with some other forms of autogenous welding, therefore, the line of demarcation is not so distinctly drawn if the electrode metal and parent metal should differ in analysis.

After the first bead has been deposited, the next is started either at the point where the first was begun, or a turn is made at its end and the next started without the breaking of the arc. The following beads are deposited the same as the first with the exception that the arc is made to climb the side of the preceding bead in its zigzag path, as shown in Fig. 4, in order to secure a good union between the different beads and prevent overlapping between them. The result of carrying the arc in a straight line is shown in Fig. 5, while that of carrying the arc in a zigzag path without climbing the side of the preceding bead is illustrated in Fig. 6. Fig. 7 shows the results of climbing the side of the bead. It will be noted that the following results are obtained: (1) Greater ease in cleaning preparatory for the second layer. (2) Easier to obtain good fusion between layers when deposited upon a smooth surface. (3) Less waste when the surface is to be machined. (4) The zigzag method will make the

penetration more even under the width of the bead and not greater at one point than another. Beads deposited by this method will be about $\frac{3}{16}$ in. thick, $\frac{1}{4}$ or $\frac{5}{16}$ in. wide and have a penetration of about $\frac{1}{16}$ in. when $\frac{1}{8}$-in. electrodes are used. Beads of other sized electrodes will be in proportion.

The metal on which welding is to be done, must be thoroughly cleaned. All scale and rust must be removed. Carbon in the form of soot and graphite, also all carbon-bearing compounds, such as grease and oil that will be decomposed, either in the arc or under the influence of the heat of the arc, must be removed entirely, even if it is necessary to heat the piece in a furnace. The oxy-acetylene torch and the lye bath are useful as grease and oil removers. The danger from the carbon is that it would be absorbed by the molten metal and raise its carbon content, which, under the chilling action of the bulk of the metal, will result in a hard weld and frequently the failure of the welded section. It is necessary to remove the soot or graphite quite a distance from the weld to prevent its being attracted in the weld. Oil on the surface to be welded, in such a small quantity that it could not be detected by the welder's eye, has been found to make a weld that was difficult to machine. Such oil deposits were left in an attempt of removal by gasoline.

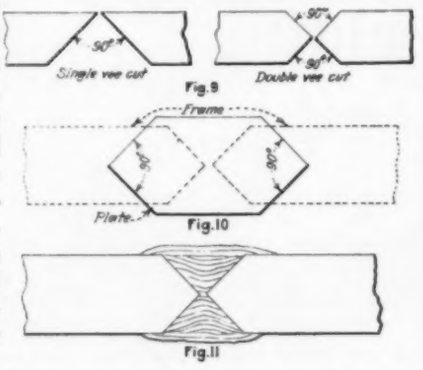


Fig. 9—Two V-type cuts. Fig. 10—Plate used beneath weld. Fig. 11—Method of placing layers

Arc Welding Locomotive Parts

The application of arc welding to machined parts of locomotives may be divided into three classes, namely, the building up of parts subject to abrasion, the assembly of new parts and the reuniting of broken parts. The welding or building up of worn parts is the simplest, and is performed as has been described, care being taken to add sufficient metal, so that when machined the surface will be smooth and free from pits and grooves at all points. Each layer must be thoroughly cleaned, preferably with a flat chisel applied with a light air hammer. All of the scale formed upon the preceding layer must be removed to prevent scale enclosures between the layers. The assembly of new parts comprises the making of machined parts from available rolled-steel plate and shapes to replace steel castings, and of attaching of such parts to frames, as it is seldom, if ever necessary to remove. In the former, it is often the case that a stronger and more serviceable part can be assembled than the casting formerly used. Neither of these have as yet been developed to any extent. The reuniting of broken parts, consists chiefly of welding breaks or cracks in such parts as guide yokes, furnace bearers, driving boxes and frames, to the last of which this article is chiefly devoted.

Arc weldinig of locomotive frames is the most economical form of frame welding known. Great care should be exercised in studying the cause of the break. As soon as a broken frame is reported, and prior to the loosening or tightening of a single nut on the locomotive, a careful examination of the condition of all machined parts, in the vicinity of the weld, should be made in order to determine the cause of the break, whether or not it was due to loose parts, such as spring stands, equalizer stands, waist bearer, frame splices and binders, or to a weakness in the section of the frame broken, or both. If the section is too weak for its duty, it should be strengthened as much as possible by reinforcement after welding, or the section cut out and a heavier-forged section welded in.

After removing all finished-machined parts, the frames should be lined up by placing jacks at advantageous points to support the weight and to prevent the frame from getting out of line after cutting. The frame will generally be found standing open at the break due to irregularities or roughness of the opposing surfaces of the fracture. A note should be made of the size of the opening. Next, the fracture should be trammed with a fixed tram, the distance between the points being at least 6 in. greater than the greatest possible distance across the weld to be made and its reinforcement. A sketch of a tram, adapted for such work, is shown in Fig. 8. Located at a distance from the fracture of approximately one-half the distance between the tram points, a center punch mark is made with a sharp punch. One of the tram points is then placed in the mark and an arc of a circle is struck on the opposite side of the fracture with the other

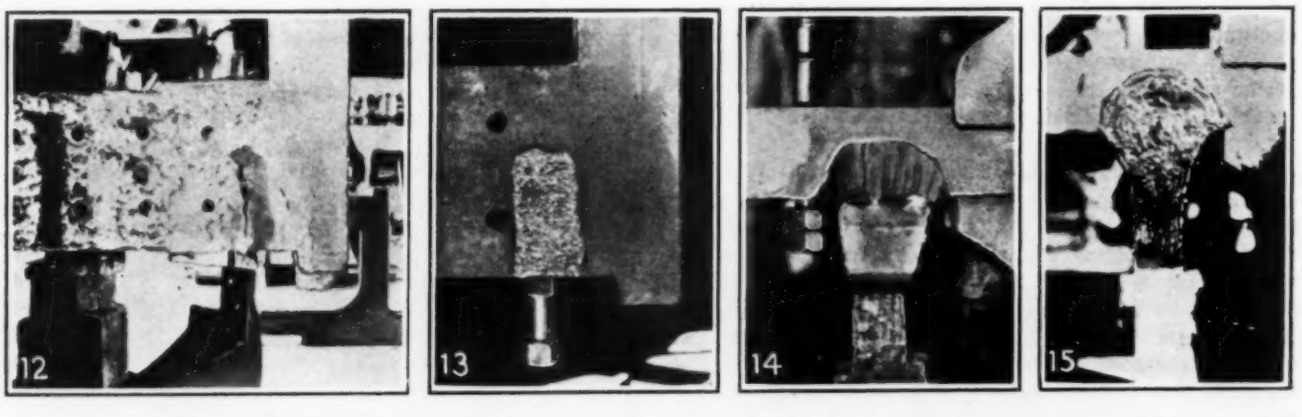
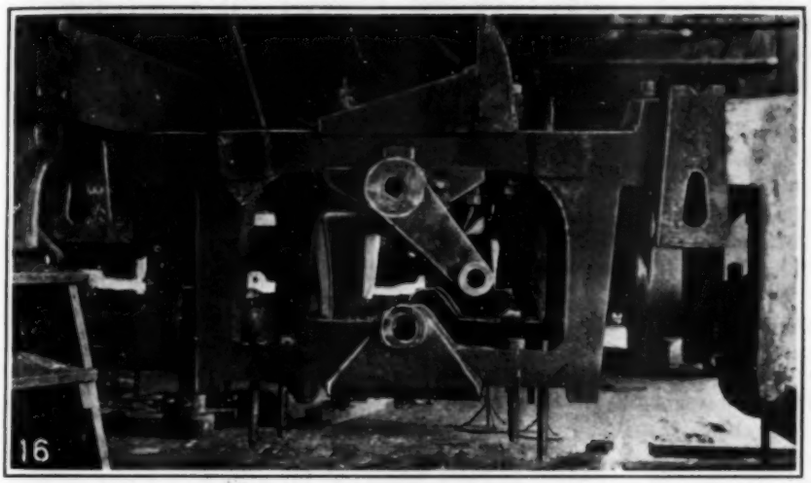


Fig. 12—Break prepared for welding. Fig. 13—Completed weld. Fig. 14—Frame ready for welding. Fig. 15—Completed weld

point of the tram. At a point on this arc, such that a line drawn through it and the above-mentioned mark, will be parallel with the portion of the frame broken, a second center-punch mark is made. These marks should be tested with the tram to make sure that the tram points fall exactly in their centers, and if not, the necessary corrections should be made.

Cutting the Frame

The frame is then cut with an oxy-acetylene torch. It is important that the cut is made as smooth as possible. To do this, the cutting torch must be in a good condition, more so than for ordinary rough cutting. The burner openings in the tip should be



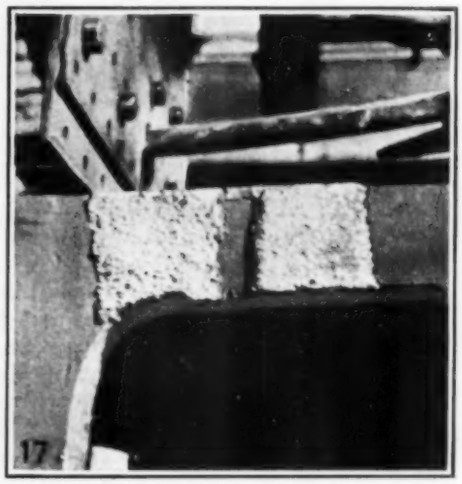


Fig. 16—Insertion of a new section. Fig. 17—Double form of weld

inspected before starting to insure that they are free from obstructions of any kind. When there are no castings, or other parts to make it necessary, the cut should not be made by whittling small portions out at a time, leaving an irregular cut, but should be made across the frame, the torch being so manipulated that deep furrows are not left in the cut surfaces. Wherever possible, the cut should be of the double V-type, as shown in Fig. 9, the opening being 90 deg. Where this is not possible, a single V-cut may be made from the top or side, but this is not advisable as it encourages warping of the frame. It is a simple problem in geometry to prove that twice the metal is required to fill a single V-weld, as is required to fill a double V-weld.

The next operation is to make the allowance for the contraction of the weld. This will be found to vary from $\frac{1}{16}$ to $\frac{3}{16}$ in. depending on the size of the frame, the amount of heat used and the general method of welding. No set amount can be specified, due to the size of the section and the conditions under which the weld must be made.

Under ordinary conditions, the contraction in a section about 4½-in. wide by 5-in. thick will be about $\frac{1}{32}$ in. when the method of welding to be described is followed. By the use of jacks or wedges properly placed the frame is expanded at the location of the weld until the trams show the opening necessary to make the proper allowance for the contraction, care being taken to allow for the amount that the fracture was open prior to cutting.

When it is desired to use a plate beneath the weld its thickness should be about that of the reinforcement to be added to the sides. The plate should be diamond pointed as shown in Fig. 10. The width of the plate should be equal to the over-all width of the frame and the reinforcement to be added while its length should be such that the outline of its protruding sides will conform approximately to that of the reinforcement to be added. The use of plates beneath frame welds has almost been discontinued in the Southern Pacific shops.

The size of electrodes, or welding wire used in frame welding, is $\frac{1}{16}$ in. in starting, and until the sections being welded have warmed up, after which $\frac{3}{16}$-in. electrodes are used. Bare mild-steel electrode is used at present and giving satisfaction.

When the plate is placed beneath the location of the weld it is used as shown in Fig. 10 and securely welded. The opening at the apex of the V's, cut in the frame, is then closed. With an air hammer and a flat chisel, the scale is thoroughly removed from the added metal. The opening is then filled by vertical layers of welded metal, being placed first on one side, then the other. Each layer is thoroughly cleaned with the flat chisel and air hammer until no sign of scale remains, then, with a bobbing tool having a peen $\frac{3}{16}$ in. in diameter and used in the air hammer, the entire surface of the layer is lightly worked in order to relieve the internal strains as far as possible. The cleaning and bobbing should be done while the metal is warm. If the weld is large, the welder should clean and bobb the work after each 20 sq.in. of surface has been covered. The beads that form the layers are not brought abruptly to the side of the V-cut, but are lapped on the side about from $\frac{1}{8}$ to $\frac{1}{4}$ in. to insure a good hitch to the parent metal. Fig. 11 shows the manner in which the layers are placed, also the layers of the reinforcement. The layers of the weld proper, after being placed as mentioned, will become concave, and after the outer surface of the frame is reached, the concaved surface should be filled slightly beyond flush. Each layer of the reinforcement should lap about $\frac{1}{8}$ in. beyond the preceding layer, producing a rounded outline that gradually slopes back to the frame, preventing an abrupt change in the cross section.

The amount of reinforcement that should be used cannot be so specified that it will suit all cases. A few locations will require from fifty to sixty per cent while others absolutely none. Such points, as the amount of

and character of the strain to which the particular section is subjected, and whether or not the section is overstressed, should be carefully considered. Points that are subject to high vibratory strains and that require heavy reinforcement, must have long tapering ends to the reinforcement. One of the points on which particular attention should be laid, is that of cleaning. The work must be frequently brushed with a wire brush to remove the particles in dust form that gather on the work and all of the scale. Failure to properly clean the work generally results in the failure of the weld.

Placing Beads With the Strain

The beads forming the layers should always be so placed, that they are in line with the strain. It will be found that welders of little experience cannot successfully place the vertical beads, since skill is required to get a good hitch at the lower end of the bead. In this case, a welder should be permitted to make welds in vertical sections by laying horizontal beads until he has had four or five months' experience in welding frames. Beads perpendicular to the strain make a weaker weld than one made of beads parallel to the strains, and it would be necessary to add extra reinforcement to the weld to overcome this weakness. In Fig. 12 is shown a break prepared for welding, as described. The break, extending from both sides to the binder bolt, was V-cut, Fig. 13 showing the weld completed. In order to facilitate redrilling and reaming, a bolt of proper taper was lightly driven in the bolt hole and welded. As a casting is placed on the inner side of the weld, no reinforcement was added, but the outer side was reinforced $\frac{3}{8}$ in. Fig. 14 illustrates another frame prepared for welding. The break is through an autogenous weld of another type, located at the top of a frame stiffener, midway between the front and main jaws of a Mogul-type locomotive. A wide cut was required in order to remove all the old weld material and the portion of the frame that was affected when the weld was made. The illustration shows a block of soft steel, placed so as to divide the large weld into two small welds, thereby saving considerable time and material. The contraction of the weld was $\frac{3}{16}$ in. Fig. 15 shows the weld completed, having been reinforced $\frac{3}{8}$ in. on each side.

Applying A Top-Rail Section

The application of a new top-rail section, between the front and intermediate jaws of a Consolidated-type locomotive, is shown in Fig. 16. Plates, bent to conform to the curve of the fillets beneath each weld location, were welded to the jaw pedestal adjacent to the weld location. The object of the plates was to support the new section prior to welding and to assist in the alignment of the section. The plates were removed after welding. The left-hand weld was made first, the right end of the section being clamped to resist warping in any direction. After the left-hand weld was securely tied and a number of layers built to equal about one-third the width of the frame, the right-hand weld was tied in a similar manner, after which both welds were carried to completion as mentioned. For the insertion of a new section, as shown in Fig. 16, the frame should not be expanded to double the allowance for contraction of a single weld, as one might at first think. It should be about one and two-thirds of the allowance of a single weld if the second weld is started immediately after the initial welding is stopped on the first, or one and one-third the allowance for a single weld if the initial welding of the first is permitted to reach atmospheric temperature before welding is started on the second. These figures are based on the results of actual experience and not on theoretical calculation.

A double weld, that also was applied due to the failure through an autogenous weld of another type, the removal of which necessitated a wide opening being cut in the frame, is shown in Fig. 17. It was handled similarly to the weld illustrated in Figs. 14 and 15. As shown, the beads were placed horizontally in line with the stress.

Various forms of laminated welds in locomotive frames have been attempted with a fair degree of success, but they have been abandoned due to the psychological effect on the welder, since they lead the welder to believe that almost any type or shape of scrap may be buried in the weld with good results. An examination of several laminated welds that have failed, disclosed the fact that many forms of scrap had been used to fill the V-notch cut in the frame, including nuts and high-carbon steel, instead of a specified material. Rigid orders have been issued that only the solid form of weld, described in detail, should be used in the future.

Teaching Drafting

By John F. Hardecker

Jack Brown and Bill Smith, fellow chief draftsmen, chanced to meet while out for a Sunday morning walk. Their conversation drifted back to school days.

"Here's an incident that came to my attention only the other day," said Bill, "that shows a worthwhile modern trend in teaching drafting."

"You know that some of our younger men, as probably some of yours, are studying at night school to improve themselves. They are taking up structural drawing at the local high school. Apparently, it has been the regular orthodox course, with the usual heavy emphasis on neatness and detail, and the time element entirely neglected."

"Yes," said Jack, "How well do I remember Professor Jones and his cartography course. We made a complete map of our summer survey, on which we had to letter the names of fifty property owners in Roman lettering, three thirty-seconds of an inch high with a crow quill pen."

"And with what pride the professor used to hold up for our admiration the work of a man who produced wonderfully neat work—at the rate of one name an hour—while we were trying to do four or five!"

"He was thoroughly disgusted with our apparent lack of interest."

"Well, in this school our men are going to show interest," announced Bill. "The regular instructor became ill and a new man took his place for the balance of the term. Our boys were certainly surprised and tickeled when he gave the highest mark to the man who finished first with a reasonably neat drawing, and when he just barely passed the previous 'star' of the class who was wont to take his work home and put in more than twice the time the rest of them were taking."

"Yes," agreed Jack, "that new instructor had the right idea. His students will certainly get further in their practical work for having a true appreciation of the importance of the time element."

Automotive Production

Forging and Machining Connecting Rods

By Fred H. Colvin
Editor, *American Machinist*

This article shows the use of forging machines and special dies to secure rods that require but little machining—Special fixtures and machining are also used

IN ADDITION to the crankshaft work previously described, the forge shop of the Fairbanks, Morse & Co. plant at Beloit, Wis., produces a large number of connecting rods of various sizes. The rods for the Diesel engine are of the marine type, one of the larger rods being shown in three stages of the forging operation, in Fig. 1. The size of the rod shown can be judged by comparing it with the size of the man in Fig. 6 and by considering that both the crankpin and the piston-pin holes of the finished rods are approximately 8 in. in diameter.

At *A*, Fig. 1, both ends of the round bar, of which the connecting rod is made, have been upset, one for the piston pin end and the other for the foot. As will be seen in Fig. 7, the rod is of the marine type, with the crankpin bearing attached to the foot by means of through bolts.

In the second stage, *B*, Fig. 1, the round head has been practically formed and the other end broken down to such a shape as will allow it to be forged to the completed shape of the foot at the next heat. At *C*, Fig. 1, is a rod with the foot completely formed and the piston-pin end pierced so as to reduce the amount of machine work to a minimum.

The Forging Operations

Some idea of the forging method can be had from Fig. 2, in which the piston-pin end is being placed in the machine for the completion of the forging on this end. The hole is punched as a separate operation. The type of forging machine and the method of handling the forging by an electric hoist are shown.

A few of the dies used in the forging press are shown in Fig. 3, *A* being the die in which the head is formed and *B* the die used in completing the foot or flat end of the rod. At *C* is the die used in punching the round end and at *D* the punch used. At *E* is the punch used in breaking down the foot of the rod to the shape shown in *B*, Fig. 1, the die for this operation being shown at *F*, while the finishing punch that forces the foot to fill out the die *B* and flattens the end, is shown at *G*. These are only a few of the dies used in the forge department, but their size gives a good idea of the extent to which machine forging is being used by Fairbanks, Morse & Company.

The quality of the forging secured by the use of the forging machine and proper dies, leaves little machine work to be done, as can be seen by the condition of the rod shown in the lathe in Fig. 4. Here the rod has been centered at each end and runs between centers, the drive being by the angle plates shown. The operation under way is that of turning the radius where the foot of the rod joins the round or main portion. At this same setting, the flat end of the foot is faced off so as to insure its being square with the rod itself.

Fig. 1—Three stages of connecting-rod forgings

After the holes in the foot have been drilled and spotfaced, the rod is ready to have the piston-pin hole bored, as shown in Fig. 5. This view shows how the flat end

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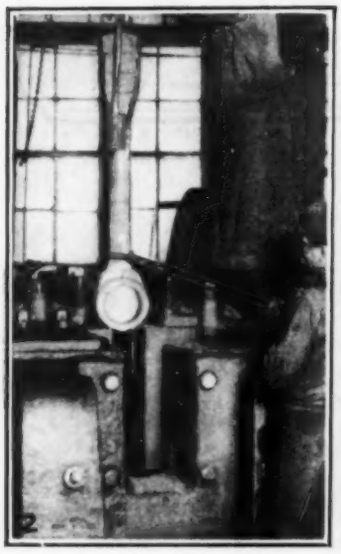

Fig. 2—Handling a rod in the forging machine.

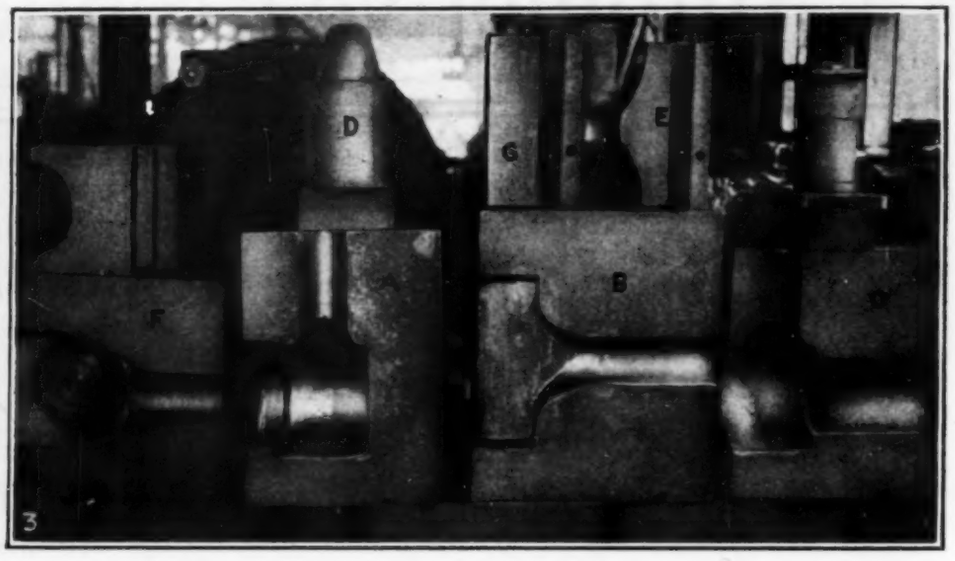

Fig. 3—Dies used in forging connecting rods

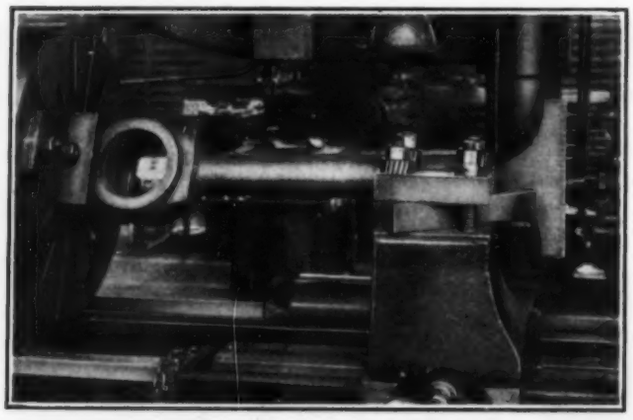

Fig. 4—Turning the end of the rod

of the foot is squared against the plate *A* of the boring fixture, and the foot located so that the piston-pin hole will be square with the crankpin bearing when the latter is bolted to the rod. With the connecting rod properly located for the alignment of the two bearings, and the piston-pin end located by the same centers used in facing the foot, the clamping screw shown holds the rod firmly in a suitable V-block, and the rod is ready for boring.

As will be seen, the boring fixture is entirely self-contained, in that the boring bar is guided at the ends by substantial bearings in the fixture itself, the ma-

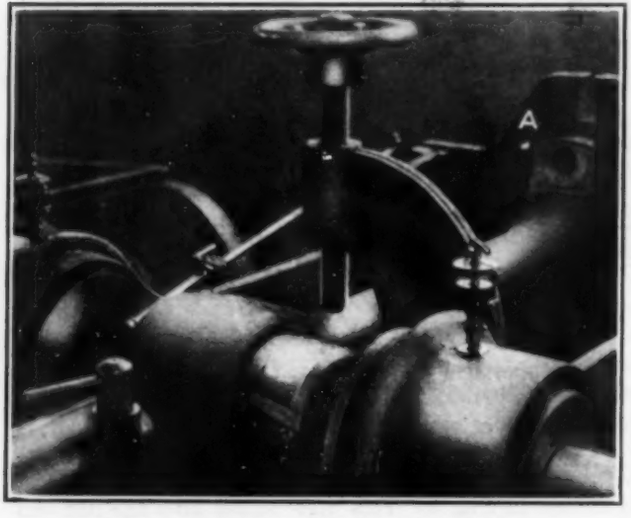

Fig. 5—Boring the piston-pin hole

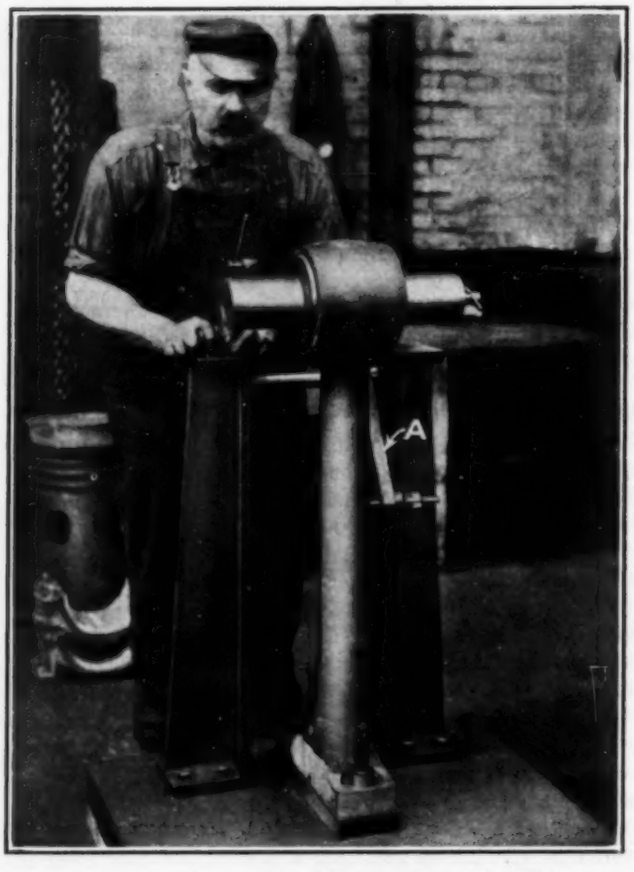

Fig. 6—Testing the alignment of the rod

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chine only furnishing power for driving the bar. As shown, the cutter head has completed boring the piston-pin hole. It will be noted that the cutter is set at about a 12-deg. angle. The liberal size of both the boring bar and the cutter head, prevents spring and insures the hole being in line and of proper size.

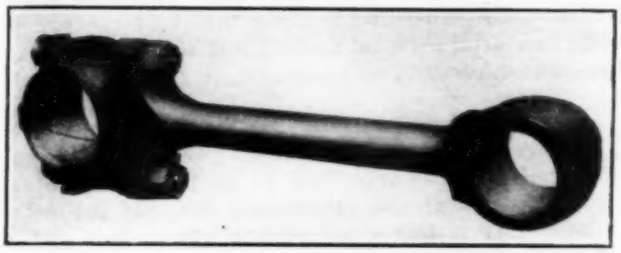


Fig. 7—A completed rod of the marine type

Before the connecting rod goes to the assembly floor, it is tested for length and parallelism in the fixture shown in Fig. 6. The foot of the rod rests on a raised plate and is positioned by the two steel plugs shown. With the piston-pin bushing in place, the hollow testing mandrel (representing a piston pin) is pushed through the upper end of the rod and each end of the mandrel gaged from the upper surface of each of the uprights by means of the dial gage shown. At the same setting, the squareness of the ends is tested in both directions by a gage in the end of the swinging arm *A*. This method of inspection resembles automobile practice, but there is a decided difference in the size of the connecting rods so tested.

In order to show the necessity for having the bottom of the foot square, a completed rod is shown in Fig. 7. Here the piston-pin bushing is in position and the two halves of the crankpin bearing have also been bolted into place. The assembly shows how the squareness of the bearing depends on the truth of the foot.

Motor Shop Problems

Quiet Running Gears

By Frank C. Hudson

There have probably been as many sleepless nights and as much wear and tear on the gray matter over the question of quiet transmission gears as any other part of the automobile.

With the advent of the gear tooth grinder, it was hailed as the solution of the noise problem in transmission, but most engineers seem to have decided that, in spite of the progress made toward securing more nearly perfect teeth, the noise difficulty has not been eliminated. As one engineer expresses it, "Our experience, covering a long period of observation, seems to indicate that objectionable gear noise is derived from some repeating, or synchronous, roughness or irregularity of the tooth surface. I do not mean that one tooth outline on the gear is necessarily different from the outline of the mating gear, but it seems as though they all had similarly irregular faces across the tooth which might be compared to corrugation. At certain speeds, these irregularities seem to synchronize in some combination of the whole assembly of parts and produce a vibration that results in a noisy transmission.

"This conclusion seems to be verified by the fact that we can modify this sound somewhat by changes in the structures carrying the gearing and also in the method of mounting these structures. In other words, the design and stiffness of the gear box and the method of mounting it, have their effect on the noise of the transmission.

"In our endeavor to eliminate this annoying combination of conditions, we have employed large numbers of men in honing the gear teeth. They stroked the teeth from the base to the point so that the hones crossed all the machining marks, no matter how slight. This seemed to lay the grain, so to speak, in line with the engaging direction of the teeth, or radially from the axis of the gear. We even developed a semi-automatic machine for doing this honing on a manufacturing basis. It was then realized that if the gear could be smoothed up in a preparatory way while it was still soft, the amount of honing necessary would be materially reduced, and so we turned to the proposition of rolling the gears together."

Ironing Out the Wrinkles

It was at this stage that the idea was tried of rolling the gears while soft, between hardened gears of such design as to produce an ironing or wiping action over as much of the surface above and below the pitch line as was possible. Sufficient pressure was applied to iron out, or smooth up, the tooled surface of the teeth, thereby burnishing and reducing any unevenness or irregularity of tooth outline. This method worked out so satisfactorily that they found the honing could be dispensed with by substituting a tooth polishing operation after hardening.

The operation sheet describes the rolling process as follows: "Burnish teeth before hardening by rolling in both directions under pressure, between three hardened gears, but not enough to displace the normal bearing of the teeth at the pitch line nor to remove all the tooth marks from the tooth cutting operation, but only to smooth up the tooth."

The gears used as burnishing gears are produced by generating the teeth. The two driven burnishing gears are made from oversize blanks. The teeth are generated to the standard depth of tooth, but it has one tooth less than the driven gears. Rolling the gears between these burnishers produces neat surfaces which polish readily and produce a more satisfactory transmission when assembled, than they have been able to produce by any other method. There may be a sort of theory lurking somewhere in this, that the spacing and form of a series of gear teeth which are to run together, need not be minutely exact for spacing, nor precisely alike as to forms to secure the most quiet running combination. But they evidently must have a more than ordinarily smooth surface in order to have as quiet running conditions as are desirable in a first-class transmission.

There seems to be a feeling however that gear tooth grinding is here to stay and I recently saw some transmission gears that tested almost perfect on a contour or tooth-form indicator.

Essentials to Good Results in Milling

By A. N. Goddard
President, Goddard & Goddard

IN CONSIDERING good milling practice there are several fundamental points to which attention must be given—the machine, the cutter, the set-up and the work.

Attention should also be given to the following: Spindle bearings, table, saddle, knee, column and cross-rail joints. All should be kept in good condition. Feed screws and nuts should not have a quarter or half turn of backlash; outboard bearings and pendant supports and bushings should fit both the support and the running collar of the arbor. Change gears should have a full number of teeth and fit the studs on which they belong. In short there is never an excuse for attempting to do good milling on a machine out of repair. It is too expensive in these days when we demand maximum production.

It is useless to attempt to do good milling on a good machine with poor cutters. And it should be noted that poor cutters are not necessarily old cutters. For many new cutters are almost as inefficient as old cutters that have hung on toolcrib pegs for years. Many cutters are still made as they were in "the good old days" 25 or 30 years ago, with fine pitch, radial teeth, slight spiral or none at all—almost rotary files.

Tooth Form of Milling Cutter

When we consider the great contribution that was made to the art of cutting metals in the research work of the late Frederick W. Taylor, it seems as though much of it had gone unheeded. His studies of the form, angles of rake and clearance for lathe and planer tools, and the enormous increase in efficiency possible, have not been appreciated. One wonders that similar studies were not made of tooth forms for milling cutters, which are nothing more nor less than lathe or planer cutting points rotating, with work feeding past them. The radially gashed cutter is in reality hardly a cutter at all, since it has no real cutting action in its use, but merely pushes off metal. It is practically a contest between the resistance of the metal of the work and that of the cutter, as to which will yield first.

In cutting wood, the shear cut is always employed whether the cutting point be moved in a plane or rotated. This is also the correct way to cut all metals, ferrous or non-ferrous, hard or soft, whether the cut be light or heavy. Metal should always be sheared, not scraped nor pushed off. In like manner the cutting edge (if the cut be wide) should not strike the work across the full width of cut, paddle wheel fashion, but should pass across it progressively. That is, combined with the shearing cut should be the helical cutting edge which enters the work gradually, thus eliminating the shock of the full broadside cut, on the cutter, work and machine.

It is an engineering problem to determine the correct angles of rake or shear, the proper helix angles, the best angles of clearance and the tooth contour that provides maximum strength and at the same time gives adequate egress for the cuttings. The most suitable pitch of teeth and many other considerations that a milling cutter may most efficiently transform into units of finished work, every ounce of energy the machine can supply, must also be considered. The solution of these problems means good milling.

Poor milling may result with good cutters on a good machine if both work and cutters are not properly harnessed. Good cutters should always be carried on good arbors, made of such material as to give both toughness and strength. The diameters of arbors should be such as to overcome both bending and torsional strains. The keyway must not be too deep, but wide enough to carry a key that can resist the shearing action to which it will be subjected. The taper shank of the arbor must fit the taper throat of the spindle with full metal to metal contact, instead of a spot bearing caused by burrs on the shank, or chips in the hole.

Arbors Must Run True

Collars must have parallel faces free from burrs and chips. If not the arbor will be sprung when the nut is tightened and the cutter runs out. If the arbor runs out from this cause or any other, don't use it. It means that a few teeth only of the cutter will do the cutting. This will cause chattering in the work, poor work and rapid destruction of the cutter. Every tooth in a cutter was put there to cut; see that it does. If the cutter does not run true, do not use it until the trouble has been located and corrected.

Use good keys of 60-point carbon steel or its equivalent, and if the keys are hardened and drawn to a spring temper so much the better. Use keys long enough to extend through the cutter and well into collars on either side, to distribute the shearing strain on the key, and torsional strain on the arbor. This helps the collars to aid in driving the cutter by friction of collar faces.

See that the work is securely anchored to the table of the machine, always setting it as low as possible, to resist both the tendency to move along the table and to lift from it. If work is held in a fixture, see that not only the work but the fixture are well secured and that the fixture is strong enough to hold the work without springing.

Speeds, Feeds and Material

The kind of material being cut and the amount of metal to be removed must also be considered in order to get good milling. These factors determine the peripheral speed of the cutter and the table feed of the machine. In general, the peripheral speed of the cutter is in inverse ratio to the hardness of the material being cut. The harder the material the slower the speed.

With light cuts, the table feed may be as great as the nature of finish desired will permit. With heavy cuts, feeds are necessarily slower, but in such cases a heavy feed is generally better, as it eliminates chatter by allowing the cutter teeth to get a positive bite into the work. On heavy cuts, or in hard material, use slow speeds and heavy feeds. Give each tooth a chance to do its share of the work. Table feed determines production. High rotative speeds destroy the cutters by either chatter or abrasive action.

Good milling machines are frequently criticized unjustly and good cutters are hastily condemned for lack of appreciation of their appropriateness to the job. Production resolves itself into a matter of co-operation. A good machine, good cutters, good judgment in the selection of tools and securing the work, and in using proper speeds and feeds, will give satisfactory results.

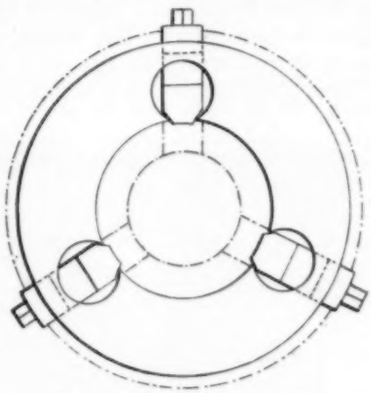
Ideas from Practical Men

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

Compensating Chuck Jaws—Discussion

BY GEO. W. SUTTON

On page 629, Vol. 62, of the *American Machinist*, in an article under the title given above, Arthur Silvester tells how he grinds chuck jaws. I am not in agreement with the method described by Mr. Silvester, since it puts the strain on the jaws and screws in the wrong direction.



Ring for use in grinding chuck jaws

I have been successful in grinding chuck jaws by using a ring as shown in the sketch. The holes in the ring are large enough to allow the first steps of the jaws to pass through. Where the edges of the holes break into the inner circle of the ring, the openings are small enough to just allow the bearing surfaces of the jaws to project into the inner space. Since the bevel on the jaws prevents their further inward movement, tightening the screws puts the strain on the jaws in the right direction.

Repairing Micrometers—Discussion

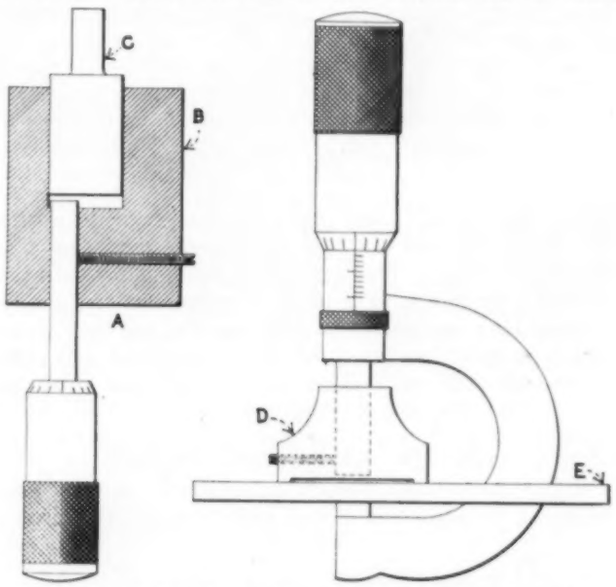
BY CHARLES KUGLER

The article by F. J. Gustav Kopsch, under the title given above and published on page 357, Vol. 62, of the *American Machinist* was very interesting, but I fail to see why Mr. Kopsch does not first lap the spindle and then lap the anvil parallel with it. His method requires considerable skill, since the spindle has a diameter of but ¼ in. and therefore does not present much of a bearing surface to guide the lap.

The method illustrated is one I have used successfully and its great advantage is that it requires but little skill, with the exception of making the necessary tools.

At *A* is the rig for lapping the spindle. The holder *B* has two holes of different diameters and out of center with each other. The lap *C* is a good fit in the larger hole. The spindle of the micrometer is held in the smaller hole by a headless setscrew, as shown. The lap is gripped in the collet of a bench lathe and the lapping is done by power, the end of the lap being, of course, charged with abrasive.

To lap the anvil, the piece *D* is fastened to the spindle to give a good bearing to prevent the lap *E* from



Method of lapping micrometer spindle and anvil

rocking. By moving the lap back and forth and keeping it fairly tight between the spindle and the anvil, the latter can be lapped parallel with the spindle.

A Cheap Extension for a Tap

BY GEORGE WILSON

I am submitting a little kink that may come in handy for some of the readers of the *American Machinist*.

It often happens that an extension tap is needed for a job, and yet the time to make one in the usual way by splicing the shank or drifting a square hole in a piece for a socket, is not justified.

An emergency extension-tap can be made by drilling a hole in the end of a rod or bar as close to the size of tap shank as possible. The first part of the hole is drilled to fit the tap shank and then a small drill is used to drill a short way. The smaller drill can be about $\frac{1}{32}$ in. or so smaller than the distance across the corners of the square on the tap, depending on the size of the tap. The end of the square is then ground to bring the corners sharp so it will act as a drift, and the tap is driven in with a soft hammer or forced in by a press.

IDEAS FROM PRACTICAL MEN

Compensating Chuck Jaws—Discussion

BY WALTER WORSTER

Although I missed the initial article under the title given above, by Charles Homewood, on page 744, Vol. 61, of the *American Machinist*, I think I can agree with Arthur Silvester in his statement on page 629, Vol. 62, as to the conditions under which a chuck should be scrapped.

Atwater has a department of turret lathes equipped with 16-in. steel body, scroll chucks with removable

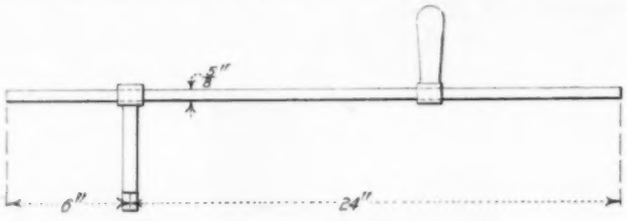


Fig. 1—Atwater's chuck wrench

jaws. Instead of using the wrenches furnished with the chucks, he had the tool room make new ones like the sketch, Fig. 1. These wrenches are handier than the ordinary wrench with a piece of pipe over the handle because they are easier to pick up, and the long, ⅝-in. handle is easier on the chuck than a piece of stiff pipe.

Someone will say "Good bye chuck," but Atwater knows that the chuck must be tight to hold while three or four heavy roughing tools are cutting all together.

White forbids his turret-lathe hands to use long wrenches or pipe, but if you look around in the lathe

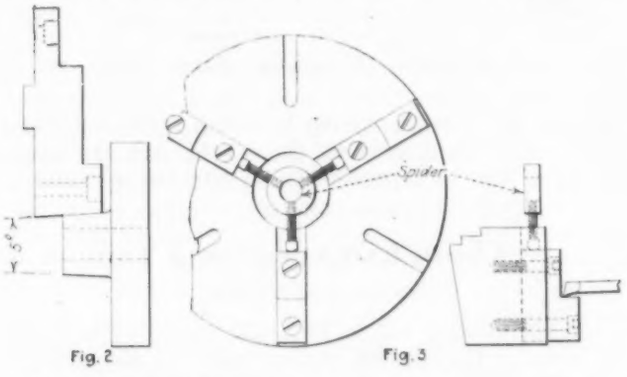


Fig. 2—How the jaws are ground. Fig. 3—Spider for holding jaws against pressure

pans you are sure to find pieces of half-inch pipe about two feet long and if you watch on the sly you will see the operator sneak one on the wrench and pull hard. If White hangs around so the pipe can't be used, the work starts popping out of the chuck in a most mysterious manner, but as soon as he goes away everything works fine.

Atwater keeps a supply of scrolls, pinions, and the dovetailed blocks that the jaws are screwed on. These are replaced as soon as needed, the same as tool bits, drills or pilot bushings, but with one object in mind—production. The hard jaws of his chucks are ground as in Fig. 2, with a slight taper to match the draft on castings and with buttress shaped teeth to help hold the work.

For boring out the steps of the soft jaws for holding second-operation work, Atwater uses spiders, Fig. 3, for outside jaws; and rings, Fig. 4, for inside jaws. The spiders are collars with three holes tapped for ½-in. setscrews. Two sizes will handle any job from 2 to 4 in. outside diameter. The jaws are marked off and roughed in the quickest manner—sometimes in the miller. After screwing the jaws in place his men give each one a good sock with the lead hammer in the direction that the strain is put on the jaw, so as to take up the lost motion.

The spider is put in the jaws just back of the section to be trued and the chuck tightened, using the same pinion every time, the hole for which is plainly marked, and the same strain as when holding the work. The job to be held is used as a gage and the jaws are bored so it doesn't quite enter. For inside jaws a ring, Fig. 4, is used to put strain on the jaws while truing them up. These rings are not easy to find and are kept religiously.

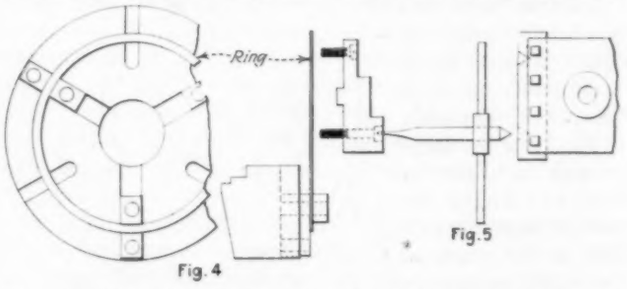


Fig. 4—Ring for same purpose when pressure is in opposite direction. Fig. 5—A capstan screwdriver and its backrest

Sometimes a ring can but cut off an old casting or a piece of flat stock can be bent edgewise and welded. The jaws are roughed out as before and the ring put as near to the section to be trued up as possible. As before, the work is used as a gage and the jaws turned so it doesn't quite go on.

White uses hay-wire wrapped around the jaws to true them up, and complains that the chuck is "out."

Accurate chuck work on production is a fine art, but easily mastered if proper care is taken in truing up

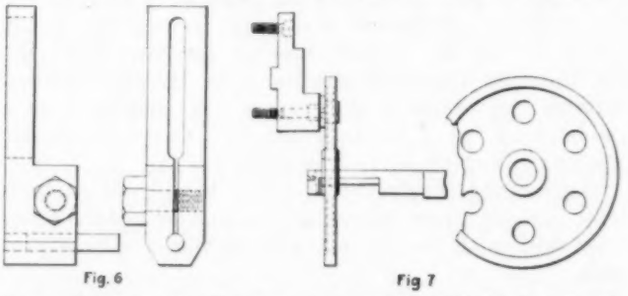


Fig. 6—Backstops for spacing work parallel with chuck. Fig. 7—Screws as additions to jaws

the jaws. Atwater's second-operation chuck work never runs out more than 0.002 in. Atwater speeds up changing the jaws with a capstan screwdriver like Fig. 5

IDEAS FROM PRACTICAL MEN

A block with two deep countersinks the same distance apart as the screw heads in the chuck jaws supports the back end of the screwdriver. For spacing the work parallel with the chuck, Atwater's foreman made up

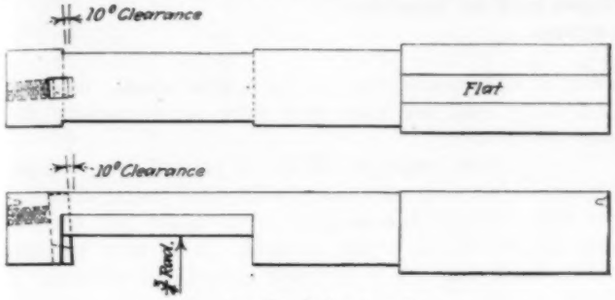


Fig. 8—Back-facing bar

sets of back stops like Fig. 6. In these are clamped cold-rolled steel plugs, which for accurate work can be faced off for every job.

One job I noticed particularly was a webbed gear with six holes about 1 in. in diameter in the web.

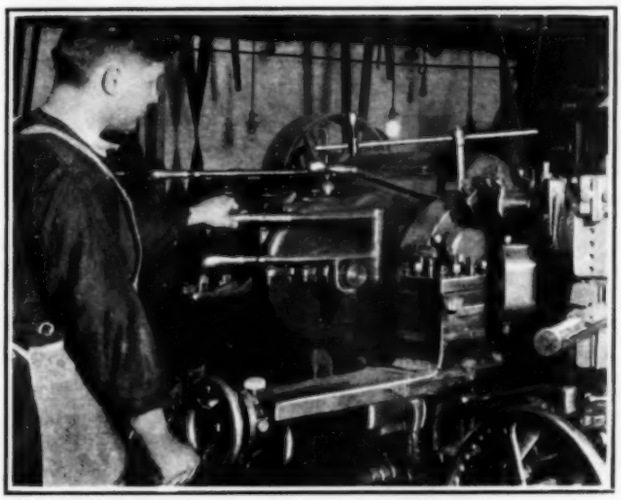


Fig. 9—Atwater's chuck wrench ready for use

The operator made three jaw-screws with special heads, as in Fig. 7. The gear was held on these screws and with the aid of the back-facing bar shown in Fig. 8, it was completed in one chucking.

In Fig. 9 is shown a turret lathe in Atwater's shop where the long chuck-wrench can be seen in a special holder where it is convenient to the operator.

A Broaching Attachment

By A. V. O'Brien

The photograph shows how a horizontal boring machine was utilized as a broaching machine by means of a self-contained attachment. At first it was planned to build a similar attachment for a lathe; but the only lathe that had a large enough spindle hole for the passage of the screw, was motor driven and not reversible.

The horizontal boring mill proved very adaptable to

Boring mill with broaching attachment

the purpose, as it was necessary only to remove the 3-in. boring bar and the outboard bearing, in order to set up the broaching unit which was fastened in place by eight bolts. The drive was accomplished by connecting the draw nut to the machine spindle by means of an Oldham coupling.

Two 1⅛-in. shafts act as compression members and also serve as guides for the crosshead to which the broach and screw are attached.

This attachment was built in the shops of the State University of Iowa in connection with the manufacture of a small bench vise. Some of the other tools used on the same job were described in the *American Machinist* about a year ago.

Simple Method for Halving Mixed Numbers

By A. H. Hammann

Frequently draftsmen and shopmen find it necessary to halve mixed numbers consisting of an odd whole number and a large fraction, such as 47$\frac{37}{64}$. It is a tedious operation to halve this number by the ordinary method.

In the case of a mixed number with an even whole number, such as 22$\frac{17}{32}$, the halving simply consists of halving the whole number and doubling the denominator of the fraction. However, with an odd number such as the first one given above, it is as easily worked out by the following method:

The whole number of the halved figure may be obtained by dividing the next lower even number by two. In the above case this will be 46 divided by 2, equalling 23. The numerator of the halved fraction may be obtained by adding the numerator and the denominator of the original fraction. The denominator of the new fraction will be double the denominator of the original fraction.

In the first example, the original fraction was $\frac{37}{64}$. The numerator of the new fraction will be 27 plus 32 or 59. The denominator will be 32 × 2 or 64. The result will be 23$\frac{59}{64}$.

Another illustration will clearly show this method. To halve the mixed number 7 $\frac{7}{16}$: One half of the next lower even number will be 3. The numerator will be 29 plus 36 or 65. The denominator will be 36 × 2 or 72. The fraction 3$\frac{65}{72}$ will be the result.

Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Speeds and Feeds for Twist Drills

Q. Often, in setting up to drill work, a data table is not at hand. Is there any general rule as to speeds and feeds for carbon drills and high speed drills in various classes of material?

A. It is a safe rule to start carbon drills with a peripheral speed of 30 ft. per min. for soft tool steel and machinery steel, 35 to 50 ft. per min. for cast iron, and 60 to 120 ft. per min. for brass. A feed of 0.005 to 0.007 in. per revolution is correct for drills ½ in. and smaller, and from 0.005 to 0.015 in. per revolution for drills larger than ½ in. At these speeds and feeds, a good cutting compound should be used when drilling steel. Cast iron and brass can best be drilled dry.

For high-speed drills, a peripheral speed of 70 to 100 ft. per min. with a feed of 0.008 to 0.020 in. per revolution is correct in soft tool steel and machinery steel, 70 to 150 ft. per min. and a feed of 0.008 to 0.040 in. per revolution in cast iron, 50 to 70 ft. per min. and feed of 0.004 to 0.008 in. per revolution in alloy steel, 200 to 300 ft. per min. and feed of 0.015 to 0.020 in. per revolution in brass. A lubricant is needed for work in steel but not for the cast iron or brass.

This information was taken from mechanical data worked out by a drill manufacturer.

In this connection, there was published on page 29, Vol. 63 of the *American Machinist* a chart for converting from ft. per min. to revolutions per minute with drills of varying sizes. This chart is one of a series that will appear each week on subjects of interest.

The Personnel Department

Q. Can you define for us the aims and responsibilities of a personnel department in a general way?

A. Broadly stated there are three general divisions into which such a department's aims and responsibilities may be divided. They are as follows:

To supply the new help needed which involves an analysis of all sources of supply.

To properly place the applicants for positions, involving the harmonizing of supply and demand.

To retain the employees by attention to wage scales, working conditions, efficiency records and vocational guidance.

Smooth Threads in Cast Iron

Q. Please inform us how to obtain smooth threads in cast iron using 1-in. to 1½-in. pipe taps. Also please tell us whether a combined pipe tap and drill having eight flutes is better for use in cast iron than one having six flutes.

A. The grade of the cast iron will determine the finish that can be obtained. If the iron is porous and coarse it will be impossible to produce a polished finish. Soda water has been used successfully for this work when it is necessary to run at a slow speed; lard oil, and white lead are also used with approximately the same results.

The six-flute combined drill and tap offers provision for more chip clearance and should work better than the one with the greater number. The latter will tend to clog and result in rough threads. It is only suitable for a finish cut where a small amount of material is to be removed.

There is however no economy in using the combination tool for this work, as a high-speed drill and a carbon-steel tap are best suited and the correct speed of one does not correspond with that of the other.

Aligning a Line Shaft

Q. I propose setting up fifty feet of line shafting to run on ball bearings supported by post hangers, and wish to know a good method of aligning it other than by the use of a transit.

A. Obtain a piece of No. 17-gage piano wire 60 ft. long, secure it below your line, fast at one end, and with a 60-lb. weight over a pulley at the other. The anchor and the pulley should each be 5 ft. beyond the ends of the 50 ft. shaft, and should be leveled below the desired elevation of the shaft.

With the tension due to the weight there will be a known sag in the wire which will measure $\frac{1}{16}$ in. at 10 ft. from the ends of the wire, or 5 ft. from the ends of the shaft. At the center it will sag $\frac{1}{4}$ in. By taking vertical measurements from the shaft to the wire at various points and by taking the correction for sag into consideration, you can secure accurate horizontal alignment. For side alignment, the wire can be stretched beside the shaft and measurements needing no corrections can be taken.

This information is taken from the American Machinists' Handbook, page 490, third edition.

Arc Welding

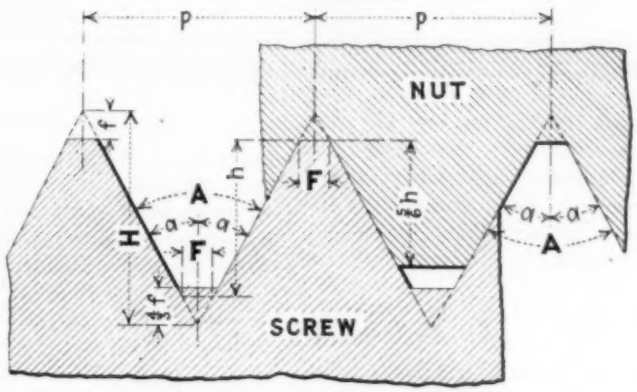
Q. What is the difference between metallic arc welding and carbon arc welding?

A. In the former, the arc is drawn directly between the metal to be welded and a metallic electrode which melts into the weld. In the latter, a carbon is substituted for the metallic electrode as a means of establishing the arc and generating heat to melt a rod which is held independently in the path of the arc.

Metallic arc welding has the advantages of requiring a comparatively low power input, and to result in a more homogeneous and better appearing weld.

Carbon arc welding, on the other hand, is the faster of the two methods and can be used to advantage for building up metal, welding parts where appearance is not essential and for such work as plugging holes in castings. The carbon electrode is also used for metallic arc cutting of materials and for removing excess stock.

Standard Thread Systems



National Form of Thread

n = number of threads per inch
H = 0.866025 p depth of 60° sharp V thread
h = 0.649519 p depth of national form thread
5/8 h = 0.541266 p
F = 0.125000 p width of flat at crest and root of national form
f = 0.108253 p = 1/8 H = 1/6 h } depth of truncation

National Coarse-Thread Series

Identification		Basic Diameters			Thread Data						
Sizes	Threads per Inch n	Major Diameter D	Pitch Diameter E	Minor Diameter K	Metric Equivalent of Major Diameter	Pitch p	Depth of Thread h	Basic Width of Flat p/8	Minimum Width of Flat at Major Diameter of Nut p/24	Helix Angle at Basic Pitch Diameter	
		Inches	Inches	Inches	mm.	Inches	Inches	Inches	Inches	Deg.	Min.
1	64	0.073	0.0629	0.0527	1.854	0.01562	0.01015	0.00195	0.00065	4	31
2	56	.086	.0744	.0628	2.184	.01786	.01160	.00223	.00074	4	22
3	48	.099	.0855	.0719	2.515	.02083	.01353	.00260	.00087	4	26
4	40	.112	.0958	.0795	2.845	.02500	.01624	.00312	.00104	4	43
5	40	.125	.1088	.0925	3.175	.02500	.01624	.00312	.00104	4	11
6	32	.138	.1177	.0974	3.505	.03125	.02030	.00391	.00130	4	50
8	32	.164	.1437	.1234	4.166	.03125	.02030	.00391	.00130	3	38
10	24	.190	.1629	.1359	4.826	.04167	.02706	.00521	.00174	4	39
12	24	.216	.1889	.1619	5.486	.04167	.02706	.00521	.00174	4	1
1/4	20	.2500	.2175	.1850	6.350	.05000	.03248	.00625	.00208	4	11
5/16	18	.3125	.2764	.2403	7.938	.05556	.03608	.00694	.00231	3	40
3/8	16	.3750	.3344	.2938	9.525	.06250	.04059	.00781	.00260	3	24
7/16	14	.4375	.3911	.3447	11.113	.07143	.04639	.00893	.00298	3	20
1/2	13	.5000	.4500	.4001	12.700	.07692	.04996	.00962	.00321	3	7
9/16	12	.5625	.5084	.4542	14.288	.08333	.05413	.01042	.00347	2	59
5/8	11	.6250	.5660	.5069	15.875	.09091	.05905	.01136	.00379	2	56
3/4	10	.7500	.6850	.6201	19.050	.10000	.06495	.01250	.00417	2	40
7/8	9	.8750	.8028	.7307	22.225	.11111	.07217	.01389	.00463	2	31
1	8	1.0000	.9188	.8376	25.400	.12500	.08119	.01562	.00521	2	29
1 1/8	7	1.1250	1.0322	.9394	28.575	.14286	.09279	.01786	.00595	2	31
1 1/4	7	1.2500	1.1572	1.0644	31.750	.14286	.09279	.01786	.00595	2	15
1 3/8	6	1.3750	1.2835	1.1828	34.925	.16667	.10825	.02083	.00694	2	11
1 1/2	6	1.5000	1.3917	1.2835	38.100	.16667	.10825	.02083	.00694	2	11
1 5/8	5	1.6250	1.5168	1.4087	41.275	.20000	.12990	.02500	.00833	2	15
1 3/4	5	1.7500	1.6201	1.4902	44.450	.20000	.12990	.02500	.00833	2	15
1 7/8	4 1/2	1.8750	1.7451	1.6152	47.625	.22222	.14434	.02778	.00926	2	11
2	4 1/2	2.0000	1.8557	1.7113	50.800	.22222	.14434	.02778	.00926	2	11
2 1/4	4	2.2500	2.1057	1.9613	57.150	.25000	.16238	.03125	.01042	1	55
2 1/2	4	2.5000	2.3376	2.1752	63.500	.25000	.16238	.03125	.01042	1	57
2 3/4	4	2.7500	2.5876	2.4252	69.850	.25000	.16238	.03125	.01042	1	46
3	4	3.0000	2.8376	2.6752	76.200	.25000	.16238	.03125	.01042	1	36

National Fine-Thread Series

		Inches	Inches	Inches	mm	Inches	Inches	Inches	Inches	Deg.	Min.
0	80	0.060	0.0519	0.0438	1.524	0.01250	0.00812	0.00156	0.00052	4	23
1	72	073	0640	0550	1.854	.01389	.00902	.00174	.00058	3	57
2	64	086	0759	0657	2.184	.01562	.01015	.00195	.00065	3	45
3	56	099	0874	.0758	2.515	.01786	.01160	.00223	.00074	3	43
4	48	.112	0985	0849	2.845	.02083	.01333	.00260	.00087	3	51
5	44	125	1102	0955	3.175	.02273	.01476	.00284	.00095	3	45
6	40	138	1218	.1055	3.506	02500	.01624	.00312	.00104	3	44
8	36	.164	.1460	.1279	4.166	.02778	.01804	.00347	.00116	3	28
10	32	190	.1697	.1494	4.826	.03125	.02030	.00391	.00130	3	21
12	28	216	.1928	.1696	5.486	.03571	.02320	.00446	.00149	3	22
1/4	28	2500	.2268	.2036	6.350	.03571	.02320	.00446	.00149	2	52
5/16	24	.3125	2854	.2584	7.938	.04167	.02706	.00521	.00174	2	40
3/8	24	.3750	.3479	.3209	9.525	.04167	.02706	.00521	.00174	2	11
7/16	20	4375	.4050	.3725	11.113	.05000	.03248	.00625	.00208	2	15
1/2	20	5000	.4675	4350	12.700	.05000	.03248	.00625	.00208	1	57
9/16	18	5625	5264	.4903	14.288	.05556	.03608	.00694	.00231	1	55
5/8	18	6250	5889	.5528	15.875	.05556	.03608	.00694	.00231	1	43
3/4	16	7500	7094	.6688	19.050	.06250	.04059	.00781	.00260	1	36
7/8	14	.8750	.8286	.7822	22.225	.07143	.04639	.00893	.00298	1	34
1	14	1.0000	.9536	.9072	25.400	.07143	.04639	.00893	.00298	1	22
1 1/8	12	1.1250	1.0709	1.0167	28.575	.08333	.05413	.01042	.00347	1	25
1 1/4	12	1.2500	1.1959	1.1417	31.750	.08333	.05413	.01042	.00347	1	16
1 1/2	12	1.5000	1.4459	1.3917	38.100	.08333	.05413	.01042	.00347	1	3

The national coarse threads are recommended for general use in engineering work, in machine construction where conditions are favorable to the use of bolts, screws, and other threaded components and where quick and easy assembly of parts is desired

The national fine threads are recommended for general use in automotive and aircraft work, for use where the design requires both strength and reduction in weight and where special conditions require a fine thread.

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Punch here to suit your binder

Technical Abstracts

Saving by Conveyors

J. D. Anderson, vice-president of the Fisk Rubber Co., demands that investments in either productive or service equipment shall save enough within a year to approximately repay their cost. The factory management must submit its plans for improvements to the board of directors, with a detailed statement of what changes it thinks should be made, how much these changes will cost and how quickly the investment will pay for itself. The management followed this plan when conveyors were proposed for the plant. For a trial of the conveyors, $175,000 was spent and so well were their plans worked out and put into operation that at the end of the year the factory management could point to savings amounting to approximately $1,000,000. About 80 per cent of the plant is now conveyorized. From the point where the crude rubber and chemicals enter the plant, through the various processes which turn out the sheets of rubber, the product is still moved by means of hand or electric trucks. But conveyors will some day take the place of these. Conveyors are used in the departments where the rubber and other materials are assembled into tires or tubes, and where they are vulcanized, trimmed, cleaned, inspected and packed. Conveyors are used not only to bring the work to the operator but to take it from him to the next operation. They are also used to carry the product through the processing treatments. Standing along the conveyor is a line of workmen, each of whom has his simple and thoroughly specialized operation to perform. The conveyor system is similar to that used in the Ford shops.

Conveyors have also speeded up the inspection of tires. A tire is heavy and not easy to flop over from one side to the other. By the use of a special arrangement the inspector is largely relieved of this work and can do his work much more rapidly and accurately. The tires stand on their treads, passing in a continuous stream along a group of inspectors who examine one side. Then, by means of an automatic switching device the tires are reversed so that they present the other side to the next gang of inspectors.

There are many photographs illustrating this article.—*Factory*, June, p. 915.

Electrical Furnace

The electrical furnace is defined by Carroll Wilson as a chamber which may be heated to or above 700 deg. F. by electrical means. For very high temperatures the arc and induction system is most practical but the metallic resistance type is most widely used for those processes requiring lower temperatures. The number of the resistance type greatly exceeds the number of arc furnaces, and it is with the resistance furnace that the article deals.

Any metallic resistor furnace has, first, a chamber in which the charge to be heated is placed; second, one or more electric heat generators formed of metal wire, rods, ribbons or castings, mounted and distributed so as to effectively transmit the heat to the charge; third, suitable insulation, surrounding both the heat generators and the chamber, in order to hold losses of heat to a minimum. Some means for controlling the temperature must be provided. For manual control, switches or rheostats are necessary. Suitable instruments and electrical relays are used for automatic control. The furnace equipment may or may not include a mechanism for conveying the charge into the heating chamber.

The high first cost of electrical equipment might often prove discouraging, were the other factors neglected. The disparity in furnace prices will not be so great when the auxiliaries and other factors are accounted for. In one instance, the Westinghouse Co., in one of its own plants, has installed a battery of electric furnaces where previously gas furnaces were used. The ever-present fumes had made it impossible to keep a man on that work for more than nine weeks. The electric furnaces were placed in service in 1921, and since then the operator has been changed only a few times. The electric furnaces operate continuously in the day time and frequently at night, yet they have had scarcely any repairs. They have doubled production without any increase in labor. Although the power rate is low, it is noted that the electricity here competes with natural gas selling at much less than 50c. per thousand cu.ft.—*Industry Illustrated*, June, p. 19.

X-Ray Examination of Steel Castings

Probably the first successful work of this kind was done by Dr. Davey, of the General Electric Co., in 1915. The development of the Coolidge tube made possible penetration of castings up to a considerable thickness. The technique of X-Ray photography of metals was developed still further and the value of an examination of this kind is twofold; the soundness of the material can be tested and the location and character of flaws determined. It helps the foundry to turn out work that compares favorably with that of the forge.

Very high voltage must be used. It takes 250,000 volts to get a maximum penetration of approximately 3 in. of steel, but this suffices for a large part of the work required. It is estimated that an operating voltage of 600,000 can be successfully applied, which would give a penetration of approximately 6 in. The defects observable in steel castings by this method are: First, gas pockets, which are usually clearly defined; second, sand which may be washed from a poorly rammed mold and be covered by the metal which shows up as shady areas of irregular outline.

Pipes and voids are also shown. Cracks, however, are difficult to observe except when the rays pass in the place of the crack. If cracks are suspected, it is desirable to take a series of radiographs at varying angles so as to detect cracks running on different slopes.

A number of illustrations are given with this paper.—*Mechanical Engineering*, May, p. 393.

American Machinist

Established 1877

KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

Credit Insurance for Export Trade

AN EDITORIAL in a recent issue of "Engineering" calls attention to the probable effect on the engineering trades of the proposal by the Federation of British Industries that the Government join in the insurance of credit. The proposal is unquestionably a serious one and looks to immediate action. Probably the principal factor influencing the movement is the desire to increase export trade which has suffered severely.

British machinery houses have always been noted for their sound business practices and particularly for their ability in the export field. It is to be hoped, therefore, that so radical a departure from established methods will not be made without careful consideration of every detail and a full realization of the possibilities latent within it.

It is also to be hoped that American manufacturers will not get panicky and demand half-baked legislation to enable them to compete for foreign business on an over-extended credit basis. Several bills have been introduced in Congress to supply Government aid of a very similar nature to the farmers but fortunately have failed of passage. Their proponents have been roundly criticized for their ignorance of economic laws. Manufacturers will do well to avoid a like error.

An Unwise Postal Ruling

THE Postoffice department is making strenuous efforts to improve its operation and reduce expenses and deserves every assistance. One of its late rulings, however, seems ill-advised to put it mildly. This ruling orders the postmaster at the receiving end to return to the sender all mail that is incorrectly addressed, even though the receiving office and its carriers know the correct address. The object is, presumably, to teach the sender to be careful. But the result of the ruling can hardly be called either economical or an aid to business.

A large government agency recently sent a hurry order for material to a concern that is well known to the postal authorities. But because a clerk made a mistake in one number of the address the letter was returned to the sender, 700 miles away, with a request for the correct address. The result was three days delay in the order reaching its destination, 1,400 miles of unnecessary travel and several handlings of this particular letter. All of which costs much more than supplying the address as formerly.

One firm that has been troubled by this new ruling has requested its correspondents to omit any street address and use only the city as in this case it is up to the postoffice to supply it and deliver. This will cost the receiving office more than before. As the ruling stands, a letter to the McGraw-Hill Co. or to the Ford Motor Co. would be returned to the sender if any error appeared in the street address, even though the receiving postoffice delivers hundreds of letters daily to these concerns.

While it is highly desirable that errors be reduced to a minimum and that carelessness be reprimanded, no ruling of any kind is going to bring about the millennium of making us all perfect. And after all, the function of the postoffice is to serve the people, not to train them into 100-per-centers. We should all try to make the work of the postoffice as light as possible, but this ruling adds more labor and multiplies the transportation cost by three. It should be rescinded.

Progress—or Only Change?

CHANGE is too often considered as a synonym for improvement and progress. To suggest that this is not necessarily the case is frequently considered sufficient evidence to relegate the doubter to the "old fogy" class. And yet there are times when changes seem inexcusable.

Such a case is brought out in the Godfrey article on page 146. Old man Johnson has always been fairly progressive and up-to-date, and we believe that many who are not old-timers will agree with his verdict that constant changes are not necessarily progress.

Just Suppose

JUST suppose that a man in trying to sell you an automobile starts with a price that you are sure is too high. When you object and he sees you mean it, the price comes down, not once but several times, if you have the patience to hold out.

If you do buy this particular car you are never quite sure you got it at the best price possible and your opinion of the seller is anything but trusting.

And now suppose you are selling a machine to the builder of that automobile. Do you adopt the same tactics? Your competitors compel you to, you say? Well it isn't ethical and it isn't good business and it would be fine if nobody indulged in such practices, wouldn't it?

Just suppose.

Shop Equipment News

Bilton "Pro-ducto-matics"

The Bilton Machine Tool Co., Bridgeport, Conn., is bringing out an addition to its line of automatic milling machines to be known to the trade as "Pro-ducto-matics." The machines represent an evolution from the automatic gear- and pinion-cutting machines that have for so lon ga time been made by the company, some of the movements having been eliminated and the entire machine made larger and heavier to adapt it to the rapid production of small parts that may be held in special fixtures.

The machine shown in Fig. 1, the No. 7½ "Pro-ducto-matic," has a turret that revolves about a vertical axis and indexes to four, six or eight positions as may be required. Special fixtures are necessary to hold the pieces to be machined, which fixtures are designed and built by the makers of the machines to customers' specifications or to suit the work. The location of the turret is fixed with relation to the cutter-slide.

The cutter-slide, or ram, is enclosed within a box housing to insure rigidity and precision of movement. The cutter spindle is adjustably mounted on the face of the ram and may be moved up or down as the nature of the work may require, though it has no automatic vertical movement. The outboard supporting arm, instead of being above the spindle as in the older types of machine, now branches out horizontally from the main slide, with which it is integral, and provides ample support to the outer end of the spindle directly behind and in line with the pressure of the cut.

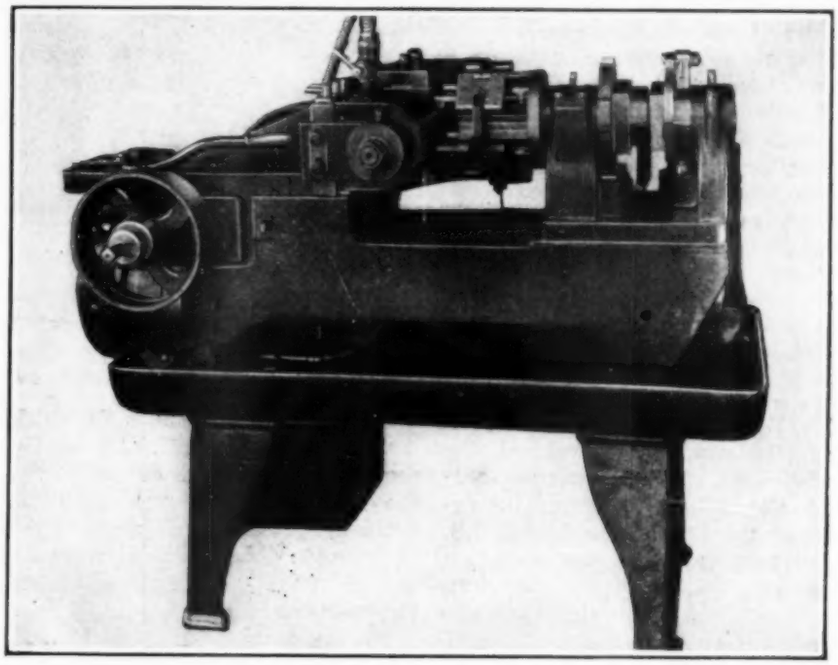


Fig. 2—The horizontal turret machine

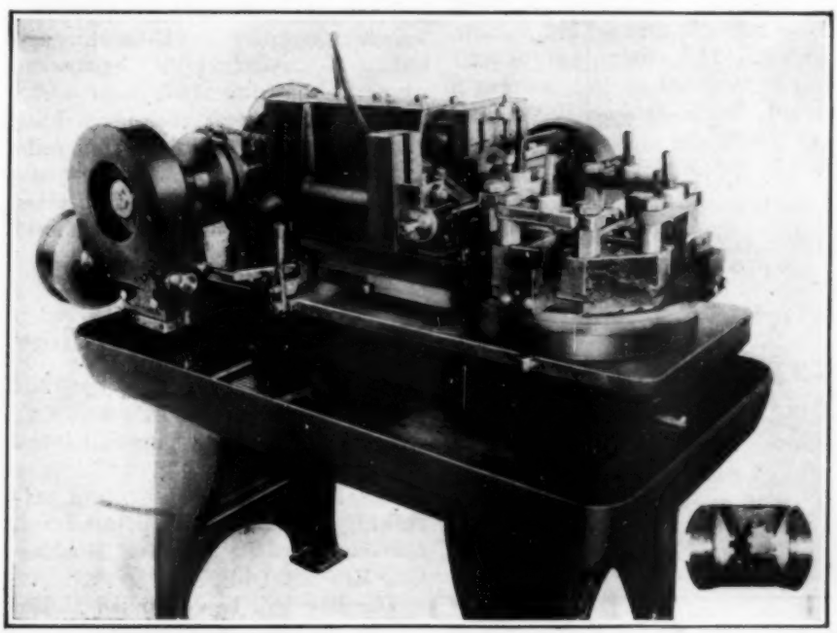


Fig. 1—Bilton "Pro-ducto-matic"

The spindle is driven through a spur and wormgear reduction train, making a powerful drive. Side-milling cutters and form cutters up to 5 in. in diameter by 3½ in. in width of profile may be used. The movement of the ram is positive in both directions, being actuated by a double-faced cam. The maximum travel is 4 in. The actual travel depends on the nature of the work and is determined by the throw of the actuating cam. This cam is mounted on the end of the camshaft, outside all bearings, and may quickly be exchanged for others of different range and relative time.

The machine may be driven by belt from an overhead line or from an individual motor mounted on the base. The base is in the form of a deep open-topped oil pan with substantial legs. The oil pan is fitted with a strainer in the opening lead-

SHOP EQUIPMENT NEWS

ing to the tank in one of the leg castings.

This machine occupies a floor space of 36x68 in., and weighs approximately 2,500 pounds.

The No. 14 "Pro-ducto-matic," shown in Fig. 2, has a turret that swings about a horizontal axis and, like that of the other machine, indexes to four, six or eight positions as the work may require. As may be seen from the illustration, the ram is of a type quite different from that of the other machine, being flat, and gibbed directly to the bed.

The ram movement is obtained from a drum-cam on a shaft below the bed of the machine, the cam-faces of which may be interchanged with others to suit the nature of the work. The maximum possible stroke of the ram is 5 in. The cutter spindle is mounted on the face of the ram and has a vertical movement of 1 in. for the purpose of adjustment. The drive to the spindle is by a 4-in double belt through a telescoping shaft and wormgear-reduction train. The floor dimensions are 36 by 68 in. and the weight is approximately 4,800 lb. The oil pan is of the same general construction but has a detachable reservoir for the oil. Circulating pump and piping form a part of the regular equipment.

The above descriptions apply to two specific designs only. The complete line is adapted to a wide variety of milling operations such as squaring, hexing, slabbing, and straddle milling. They are also tooled up for one job or are designed so they can accommodate a number of parts and operations on the same machine.

Micro Double-Headstock Aligning Grinder, Model E.G.

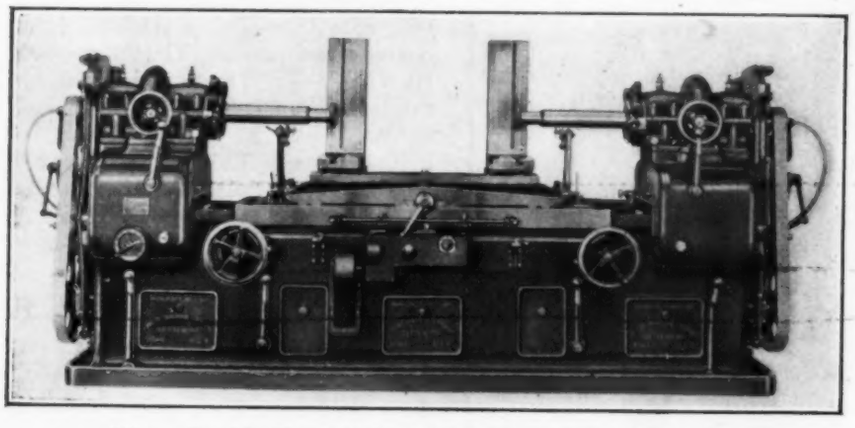
The Micro Machine Co., Bettendorf, Iowa, has developed the Model E. G., double-headstock machine illustrated by altering the design of the bed of the Model F.G. grinder previously described on page 941, Vol. 62 of the *American Machinist*, and by mounting duplicate heads on each end.

It is designed to grind machined parts where alignment of holes is important and to also face-grind where the outer face is required at right angles to the bore.

The machine will handle a variety of work by changing to and using the correct length of spindle for a given length of work. Its capacity is 5 ft. and 6 in. in length, in which it will grind to a depth of 6 in. By decreasing this length of work 1 ft., the possible grinding depth is doubled by the use of another set of spindles. Diameters between 1½ and 15 in. are within the range of the machine.

The work is secured to holding angles which are provided with the machine and mounted on the cross-slide subplate. This plate is fitted with a take-up gib to compensate for wear. The entire fixture and plate are mounted on the company's standard main table. Hand and power feeds are the same as contained in the Model F.G. previously described. Circulation of coolant is also duplicated in the two heads, feeding through the main spindles to a baffle plate, as is the pantograph drive and the motor mounting.

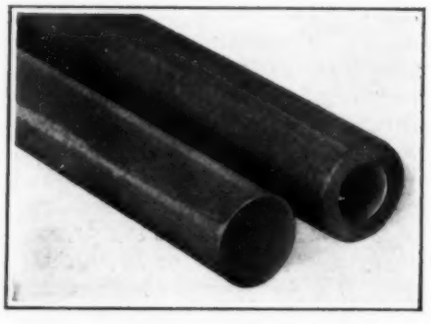
The machine occupies a floor space of 5 ft. and 9 in. in width by 13 ft. and 3 in. in length and weighs 13,000 lb. less the motor.



Micro Double-Headstock Aligning Grinder, Model E.G.

Crilly Mercury Bearing Metal

The metal is being marketed by the Metal Sales Co., 511 Bergen Ave., Jersey City, N. J., and is intended for general application to bearings. It is stocked in standard lengths of 12 in., in solid bars ranging from ¾ to 6 in. in diameter and in cored bushings from 1 to 6-in. outside diameter. Greater lengths as well as special castings and shapes are available to order.



Crilly Mercury Bearing Metal

Tests are said to have shown a tensile strength of 23,000 lb. per sq.in., a coefficient of expansion equal to that for steel, a property to resist cutting or seizing a shaft running in it when lubrication fails and that it has good wearing qualities. In appearance it resembles bronze and is said to lend itself readily to machining.

Minster High-Duty Drilling Machine

The National Automatic Tool Co., Richmond, Ind., has purchased the patent, manufacturing and sales rights for the line of drilling machines previously manufactured and marketed by the Minster Machine Co., Minster, Ohio.

The line will be continued at the company's plant in Richmond.

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Grant Bench Riveting Machines

The Grant Manufacturing & Machine Co., 85 Silliman Ave., Bridgeport, Conn., is now prepared to furnish its rotary vibrating riveter, heretofore made only with a pedestal, with a frame designed to be at-

Grant Bench Riveting Machine

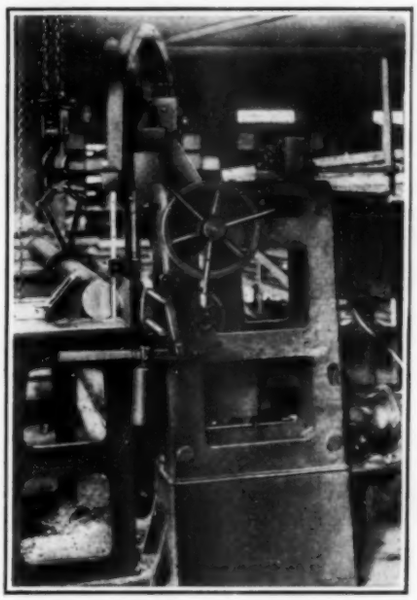
tached to a work-bench. The type is especially convenient for use in connection with a belt conveyor in small manufacturing operations where the belt travels along the back of the bench.

The machine is of the cushioned-helve type and differs in no respect from those previously furnished except in the matter of the frame. The parts will, therefore, interchange with those of the regular machine.

Stockbridge Band-Saw Limit Stop

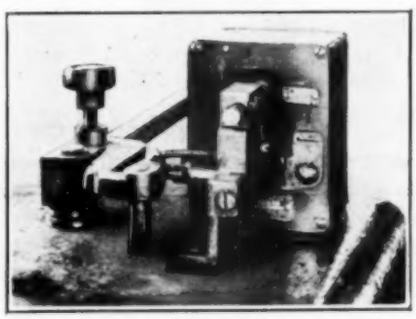
The Stockbridge Machine Co., Worcester, Mass., has incorporated an automatic stop for use on band saws, arranged so the driving-motor circuit is broken at the completion of a cut.

The control equipment for the stopping device utilizes a ¾-hp. motor and a magnetic switch, both manufactured by the General Electric Co., and a Trumbull disconnect-



Stockbridge Band-Saw Limit Stop

ing switch. When the end of a cut is reached, a cam is tripped, releasing a trigger that gives a blow to the "stop" push button.



Details of switch

By this arrangement, the slow motion of the saw itself is not used to operate the push button.

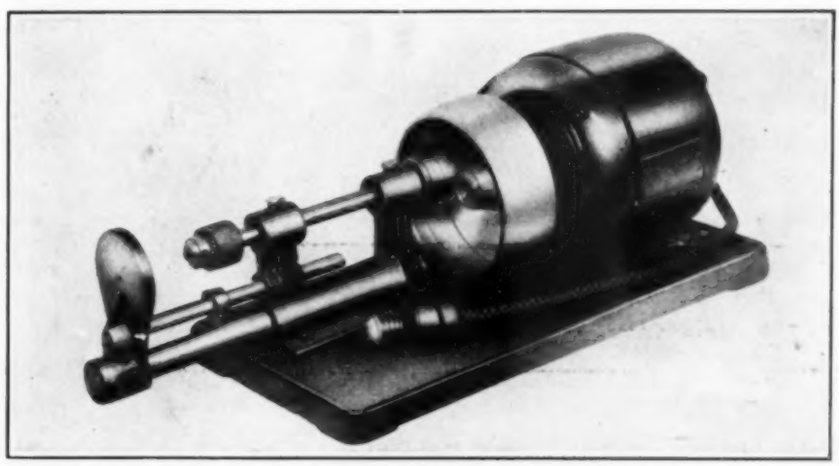
Alto Tapping Machine No. 1

An increase to the present line of equipment manufactured by the Alto Manufacturing Co., 1647 Wolfram St., Chicago, Ill., has been made by the addition of the high-speed tapping machine, No. 1, intended for the tapping of small holes up to $\frac{5}{16}$ in. in brass and $\frac{1}{4}$ in. in steel.

The principle embodied in the design is of the friction type, the spindle being equipped with a double-cone leather pulley that engages with the driving pulley as pressure is applied. When the spindle is withdrawn, the cone engages with the inside surface of the tapered ring, reversing the motion at a speed three times that of the cutting speed. Suitable fixtures or holding devices may be attached to the faceplate that is provided with an adjustable stop for tapping to predetermined depths.

The machine is a self-contained unit, having an individual-motor drive that may be connected to the ordinary light socket. Either an a.c. or d.c. motor can be furnished. It is 19½ in. long, and weighs 45 lb. complete with motor. The motor speed is 1,725 r.p.m. and the tapping speeds are 1,450 r.p.m. forward and 5,000 r.p.m. reverse. Two motor bearings and two spindle bearings, furnished with oil cups, comprise the lubrication.

It is claimed that the friction drive enables tapping to the bottom of a hole without danger of breaking the tap, also that production may be increased and tap cost reduced by the application of the machine for small work.



Alto Tapping Machine, No. 1

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Wickes Semi-Automatic Crankshaft Line-Bearing Turning Lathe, 20-Inch

The semi-automatic machine, illustrated in Figs. 1 and 2, has been added to the line of lathes built by Wickes Brothers, Saginaw. Mich. It is designed to meet the requirements necessary for machining the flange end, front end, rear journal and center bearing of a gasoline-engine crankshaft. The machine is shown at work on the center bearing.

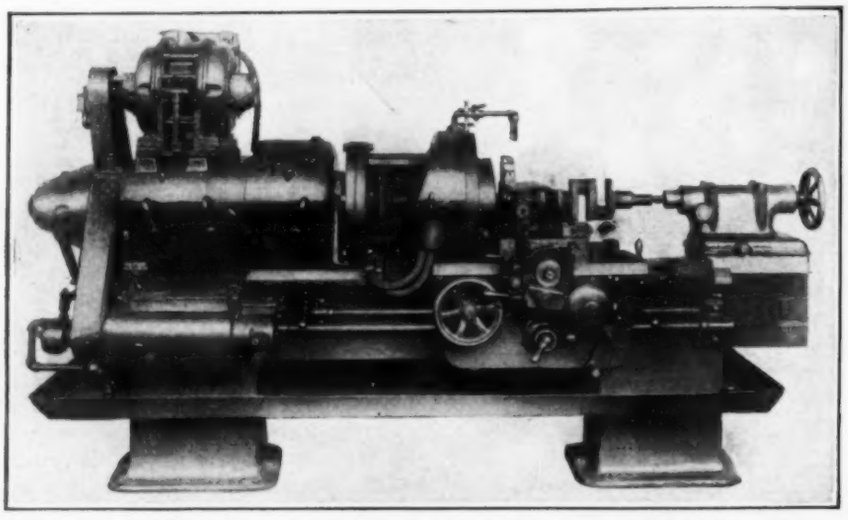


Fig. 1—Wickes Semi-Automatic Crankshaft Line-Bearing Turning Lathe, 20-Inch

The work, located on centers, is supported and driven by a floating driving head in the company's steadyrested pot chuck. There are two sets of tools used that comprise one turning bit and two combination finish-cheeking and filleting bits. These are mounted on the front and rear of the carriage on separate slides which are fed to the work simultaneously.

The tools rough and finish-cheek the work to the shoulder diameters. At this point, an automatic split feed is engaged and the feed reduced to suit the combination turning and filleting conditions. This feed is maintained until the automatic diameter stop is actuated to conclude the operation. It is said that the time required for the work on an ordinary double-cheeked shaft is between 3 and 5 minutes.

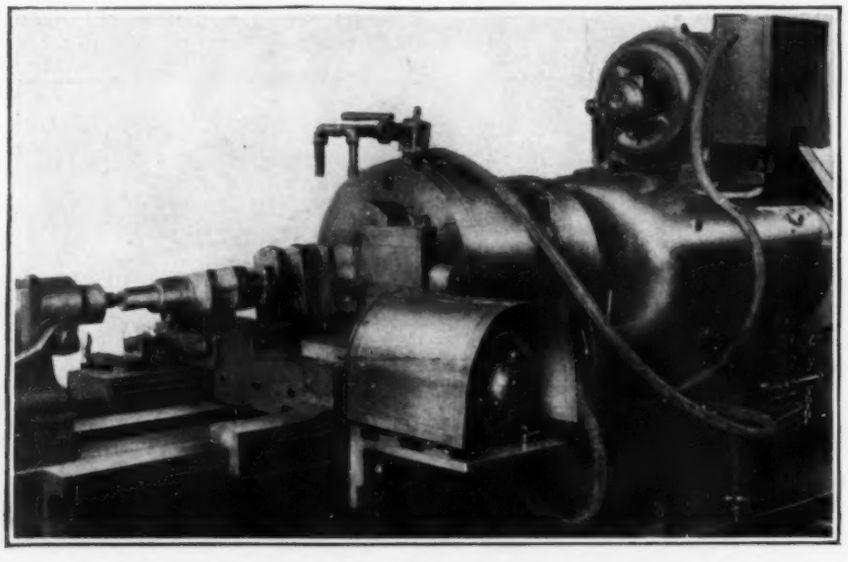


Fig. 2—A rear view showing the cross-traverse motor

A separate motor mounted on the rear of the carriage, controlled from a station set at the front of the machine, drives a rapid cross-traverse by which the tools can be moved forward or retreated to open position.

The driving motor, that can be either constant or variable speed, is mounted on the headstock, driving the machine by silent chain. It is push-button controlled. Between 5 and 7½ hp. is required.

The feed box containing eight changes and mounted at the front of the machine drives a splined shaft to the apron of the carriage. There are twelve speeds possible in the headstock.

With the exception of the main-spindle bearings, all shafts run on rollers. Lubrication is divided between oil and grease. The machine weighs approximately 6,500 pounds.

Berry Automatic Grease Cup

A grease cup containing a mechanism to maintain pressure on the grease is being marketed by the Berry Automatic Lubricators Corporation, 15 Broad Street, New York, N. Y. It is being made in 7 sizes that range in holding capacity from ⅛ to 6 oz. of lubricant and is available in either brass or as a die-casting.

Its general outside appearance is as illustrated in Fig. 1, while in Fig. 2 a sectional view is given to show the spring-actuated mechanism. In the latter view, the cup is shown as having emptied itself. To load with grease, the plunger is pressed down until the latch, which is hinged on the outside, catches and holds against the action of the spring. Grease is then put in on top until the cup is full. The cover is then put on and turned to secure it in place on the bayonet lock on the upper rim. The last part of this movement actuates the latch and releases the spring. The grease is forced through an orifice in the pipe leading into the bearing and the plunger gradually moves back to its upper position. A cup gasket in the plunger head prevents leakage past the plunger.

A small pin is attached to the plunger and projects downwards and

SHOP EQUIPMENT NEWS

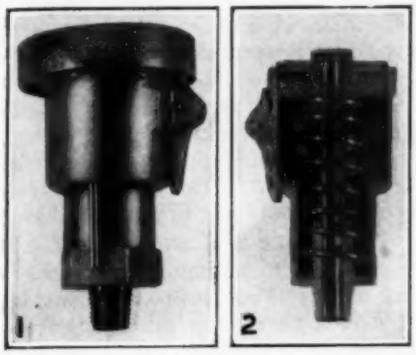


Fig. 1—Berry Automatic Grease Cup.
Fig. 2—The internal mechanism in "empty" position

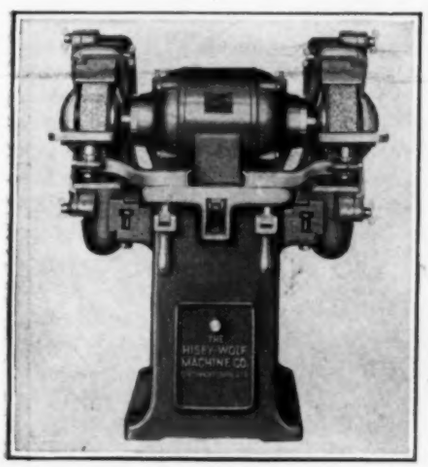
out through a hole in the bottom shoulder of the body. The amount of projection of this pin is an indication of the position of the plunger and the amount of grease remaining in the cup.

When it shows the cup to be empty, the latch which locks the cap in place is depressed, the cap is removed and the plunger is again forced to its bottom position.

"Hisey" Production Grinder, 18-Inch

The grinder has been developed and added to its line of similar machines by the Hisey-Wolf Machine Co., Cincinnati, Ohio. It is intended for heavy-duty production and general-utility grinding.

The spindle, which is 2 in. in diameter at the bearings and 1¼ in. at the wheels, is made of high-grade steel, ground to fit, and rides on ball bearings. An oil well in each bearing provides space for lubrication to suffice for a period of weeks.



"Hisey" Production Grinder, 18-Inch

The bearings themselves are fully inclosed and sealed from dust or grit.

The unit, which is fitted with a 5 hp., 1,140 r.p.m., 60-cycle motor, can be supplied for 2- or 3-phase current and 220 or 440 volts.

The machine is designed to drive two 18- by 3-in. wheels, but these are not regularly included. The guards are of one-piece construction and are provided with exhaust-pipe connections and with hinged doors for access to the wheels. An adjustable spark- and chip breaker is fitted at the top of each guard. The grinding rests are also adjustable.

An automatic starter, which is standard equipment, is mounted inside the standard and is controlled by a button located conveniently for the operator. Access to the starter is arranged for through an opening protected by a spring snap door.

The machine is 28 in. in width between the wheel centers and stands 36 in. in height to the center of the spindle. It weighs 1,100 lb. net.

"Viktor" Multi-Purpose Drilling Machine

The Henry & Wright Manufacturing Co., Hartford, Conn., has brought out a development of its "Viktor" type of drilling machine that is adapted to general-purpose drilling in machine shops and manufacturing plants. The machine has all the features of the older one that was previously described on page 530, Vol. 59 of the *American Machinist*. It has in addition a wide range of spindle speeds with a quick-change mechanism.

The machine is made with one, two, three or four spindles as desired, with center distances of either 9 or 12 in. between spindles and corresponding distances of 9 and 12 in. from the face of the column. The spindles have No. 2 Morse taper holes for drill shanks or collets, and the power is sufficient to drive a ¾ in. drill in steel. The distance from the lower end of the spindles to the surface of the table ranges from 0 to 27½ in., 6½ in. of which is traverse of the rack.

Each spindle is driven independently of the others through the medium of a 2-in. belt and pair of 4-step cone pulleys. The faces of the cone steps are beveled and a device is provided to shift the belt from one step to another while the machine is in motion. The shift is accomplished by turning the large handwheel. A spring-suspended idler maintains driving tension upon the belt and follows the movement up or down the cones as the belt is shifted.

Internal speed-reducing gears are incorporated within each cone and are brought into action by moving the lever to be seen at the left. The change from open-belt to back-gear speeds is made through a double-faced cone clutch so constructed that when the clutch is in engagement with the cone the gears are locked and revolve as a unit with it. When the lever is moved to bring the clutch into engagement with the stationary member above it the gears

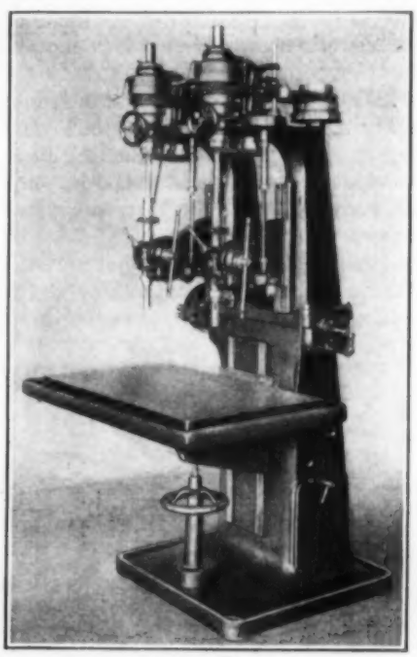


Fig. 1—"Viktor" Multi-Purpose Drilling Machine

come into action as a planetary train.

The design of the clutch is such that in neither position of engagement is there any thrust imparted to the drill spindle. When the clutch is in engagement with the cone the pressure is applied through a series of coil springs. The change from open-belt to back-gear speeds is made without undue shock or jar while the machine is running.

The feeding mechanism is the same

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as that of the earlier machines, providing hand-lever, intermittent or full-automatic movements at the will of the operator. The feed movement is driven by belt from the spindle and is ordinarily geared to give a feed rate of 0.004, 0.008 and 0.012 in. per revolution of the drill, according to the position of the belt on the three-step cones. By substituting a gear in the change train this ratio can be increased or diminished.

The machine is driven by an electric motor which is permanently mounted on the column and connected directly to the first driving shaft. The drive to the first cone is through helical gears that run in oil-filled chambers within the column. A geared pump to supply lubricant to the drilling operations is connected directly to the end of the first drive shaft opposite to the motor. All shafts run on ball bearings.

The motor runs at 1,750 r.p.m. under normal full load. The spindle speeds range from 320 to 2,400 r.p.m., in geometric progression.

The weight ranges from 900 to 2,700 lb., according to the number of spindles. The working surface of the table is 16x16 in. for the single-spindle type and is proportionately longer as the number of spindles increases. The floor dimension, front to back, is 32 in., and the width varies from 22 to 58 inches.

Kempsmith Maximillers

The Kempsmith Manufacturing Co., Miiwaukee, Wis., has revised its line of milling machines to include among other improvements a motor mounting inside the base.

In Fig. 1 a view taken at the front shows the location of the various control assemblies, a feature of the line previously described in detail in Vol. 52, page 582, of the *American Machinist*.

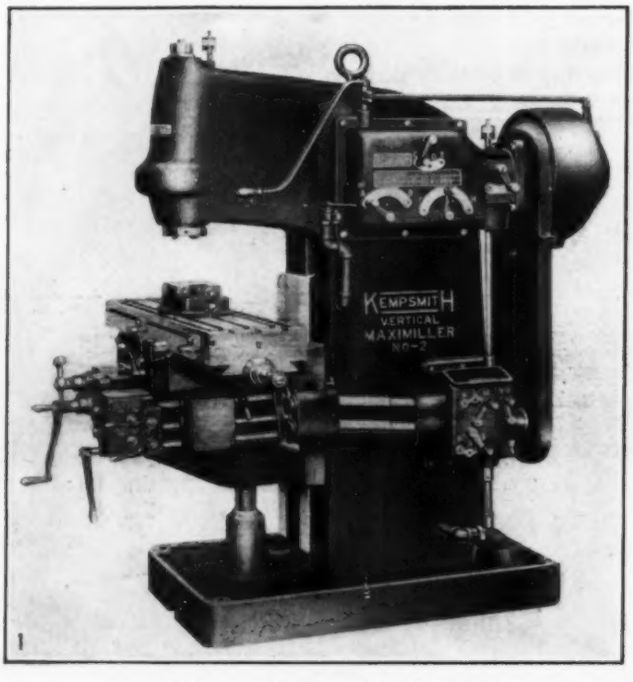
Other features which have been retained are the semi-steel main castings, the ribbing to increase strength of the frame and housings, the design of the knee with the one-piece adjustable gib, the alloy-steel spindle, the ball-bearing design of the speed transmission, the rapid power traverse and the safety-limit stops that obviate the possibility of harm should the operator shift the wrong levers. The bearings and gears in the speed and feed mechanism run in oil and are splash-lubricated. The balance of the oiling system is centralized at two points.

The coolant pump which is built into the machine is of the centrifugal type and is accessible from the outside. It delivers 14 gal. per min. at the cutters. When coolant is not required on the work, a driving clutch, with which the pump is provided, can be disengaged. The reservoir for coolant is contained in the main base.

The housing as illustrated in Fig. 2 is arranged to accommodate the driving motor. From its position inside, it drives the clutch through an inclosed silent chain. An adjustment for chain tension is accessible through a door set in the side of the main casting. Louvers are located to allow for adequate circulation of air. The motor is placed or removed through an opening at the rear after removing a cover plate, which is a minor operation. Motor sizes are recommended in accordance with the size of the machine in question.

Erratum

The description of the Garrison gear grinder, page 975, Vol. 62 of the *American Machinist*, stated that the ram had a maximum travel of 6⅜ in. and could be adjusted to 3¼-in. travel. This should have read that it could be adjusted from 6⅜ to ¾-in. travel. The machine is hydraulically operated by motors only, instead of motors and plungers as was mentioned.



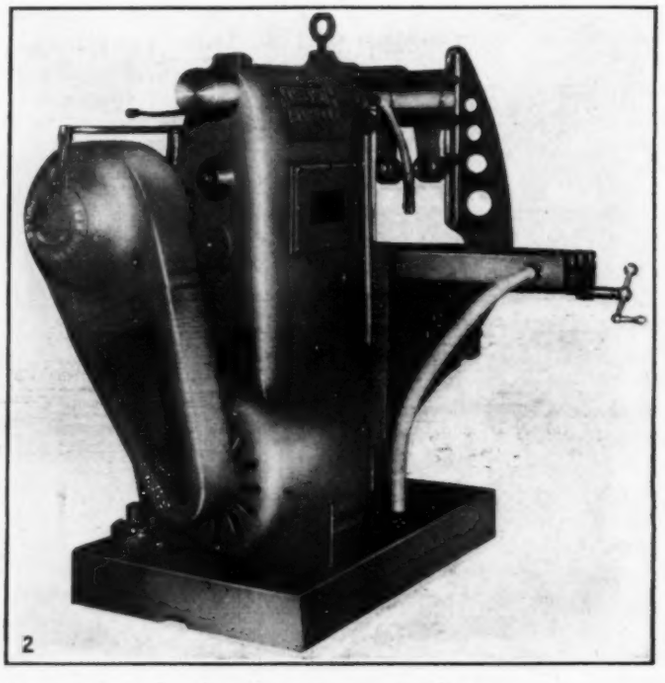


Fig. 1—Kempsmith Maximiller. Fig. 2—A rear view showing the motor mounting

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American Heating Machines

Two sizes of gas-fired heating machines, made by the American Gas Furnace Co., Elizabeth, N. J., are illustrated. With the exception of the automatic control which is illustrated with the smaller size, No. 136, in Fig. 1, and certain small details of construction, the machines vary only as to size.

The furnaces are intended for continuous annealing of small parts and for continuous heat-treating operations. They may be used singly or in tandem, and made as near automatic with conveyors and quenching tanks as may be desired.

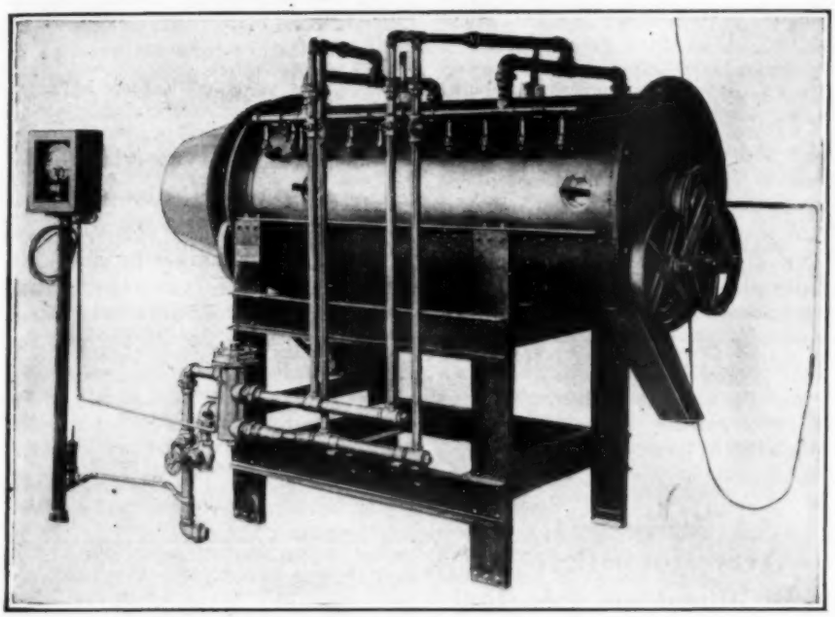

Fig. 1—American Heating Machine, No. 136

By means of the automatic control in connection with the pyrometer and the control valve illustrated in Fig. 1, temperatures can be maintained at any predetermined point without attention on the part of the operator. This automatic equipment, and also the positive pressure blower which the company recommends are subject to specification.

Referring to Fig. 2, the work is fed into the cone-shaped hopper in quantities. This hopper is equipped on its inner periphery with scoops whose capacity to deliver to a central chute leading into the heating chamber is adjustable by the small handwheels shown on the outside. The feed is practically continuous and measured. The rotating retort into which the work is fed has an inside diameter of 15 in. and, in this No. 139 size is 10 ft. in length. It is equipped with a spiral fin which has a pitch of 6½ in. and stands 4½ in. in height. The fin ends some distance from the discharge end of the retort, leaving a section of plain cylinder which acts as an equalizer to provide a practically uniform delivery from the machine.

The discharge opening at the otherwise closed end of the retort is provided by cutting through the side wall near the end to leave alternate openings and sections or bridges, which latter support the bearing at the end. Whenever it is essential that the work does not come in contact with the product of combustion, the design provides for extending the retort through the rear-end wall to discharge outside the combustion chamber.

The work coming from the side openings passes through the heating chamber ordinarily and out a chute where it can fall directly into quenching tanks or suitable receptacles. The discharge is well outside the end of the vertical support to leave room for design and application of various receptacles and automatic handling devices.

The heating chamber is provided with an insulation of Sil-O-Cel brick and is lined with refractory. A combination lighting hole is located near the discharge end to provide for watching the work as it discharges. The fire-end of the thermocouple, which projects in from the center of the end bearing, can also be seen and used as a visual check.

The burners fire tangentially and the gases pass in through the discharge opening of the retort over the work to come out from the feed end. This flow utilizes a maximum amount of the available heat and assists in rapid action and gas economy. The arrangement also enables the operator to keep a neutral atmosphere in the retort as an aid to preventing scale from forming on the work.

The machine is furnished with a special-alloy retort for high heat, or with ordinary steel as the material

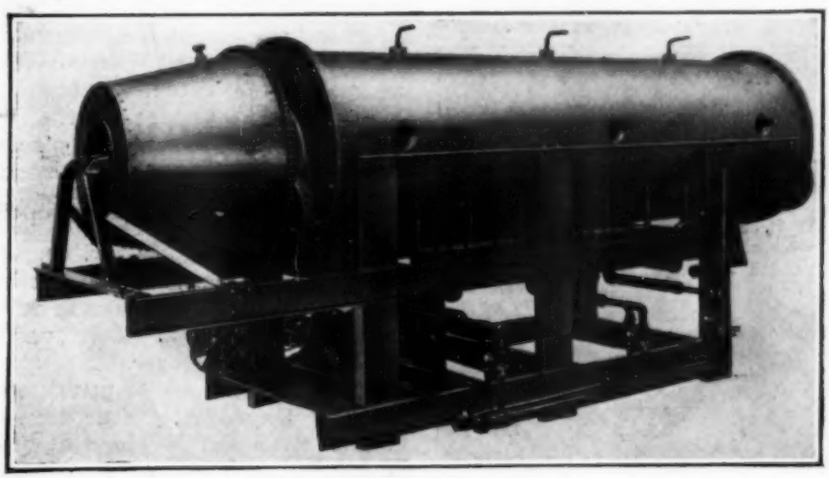

Fig. 2—The No. 139 size

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for cases in which it will serve equally well. With the retort rotating at 1 r.p.m., the work requires approximately 16½ min. to pass through.

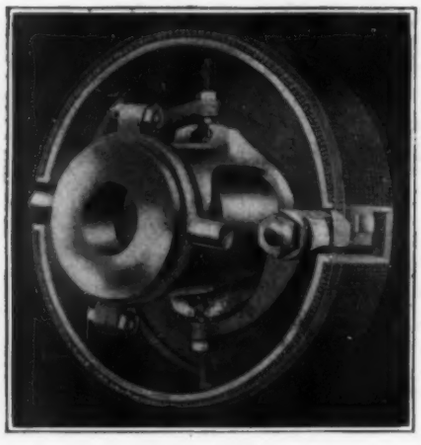
The machine is equipped with individual drive and a Reeves speed regulator which permits of change in rotating speed to suit a given piece of work. This drive connects to the retort at the feed end, the opposite end resting on idler rollers. A 1½-hp. motor is recommended.

The No. 139 machine requires approximately 17 by 5 ft. of floor space and weighs approximately 7 tons. Its capacity is in the neighborhood of 1,000 lb. of material per hour, dependent on the nature of the work. The capacity of the No. 136 machine is somewhat smaller.

The machine can be built to operate under high-pressure gas systems or with gas and air mixing systems, this being a point, however, which must necessarily be determined upon before any particular design of machine is recommended.

Hoerl Friction Clutch

The Hoerl clutch is built and marketed by the Wolf Co., Chambersburg, Pa. It is intended for general-purpose work and is made in a variety of sizes for use either as a coupling, or with a sleeve for application to a pulley. The sizes range, in rated transmission capacities, from 4 hp. at 850 r.p.m., to 700 hp. at 250 r.p.m. in 18 steps. The maximum allowable speeds at the two extremes are 3,000 and 400 r.p.m. respectively. The first five sizes which vary between 4 and 30 hp. inclusive are made to stock.



Hoerl Friction Clutch

A plate with a long hub and two substantial studs keys to the shaft. The studs carry the two Raybestos-lined half friction rings and the levers which move them against the driven shell when the clutch is engaged. Each half ring is mounted on the stud opposite to the lever which actuates it and points against the direction of rotation. In case the shell is the driving member, the levers face against the direction of rotation, while they face with the rotation if the shell is the driven member. The first arrangement is recommended.

The opposite ends of the levers are fitted with adjustable studs that ride in tee-slots in the shifter cone. The heads of the studs are fitted to the slots so there is a positive movement of the levers when the cone is moved to engage or release.

Care has been taken in the design to keep the friction surfaces at a distance from the center that will provide maximum leverage in a given size, and to protect all working parts within the shell from a standpoint of safety. The parts are made accessible by removal of a set collar.

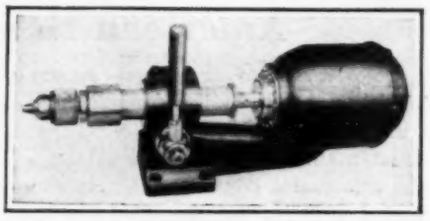
Avey Motor-Driven Drilling Unit, ⅜-Inch

The unit is built by the Avey Drilling Machine Co., Cincinnati, Ohio, for a variety of flexible applications and in a number of sizes that range from ⅜-in. capacity, as illustrated, to ⅞-inch.

There are two ⅜-in. sizes with speeds at 3,600 and 1,800 r.p.m. respectively, two ⅝-in. sizes, one direct and one geared, which operate at 1,200 r.p.m., and two similar designs in ⅞-in. capacity operating at 1,200 revolutions per minute.

In the unit illustrated the spindle is regularly fitted with a chuck and has a travel of 3 in. without a stop collar, or 2½ in. when the stop collar is included. The motor is ⅜ hp., of the drawn-shell type, and is designed for 60-cycle current. It can be furnished for 110, 220 or 440 volts and for either 2 or 3 phase.

The design is made to permit attachment by means of four screws in any plane and is especially intended for attaching to a machine where it is desired to drill an extra



Avey Motor-Driven, Drilling Unit, ⅜-Inch

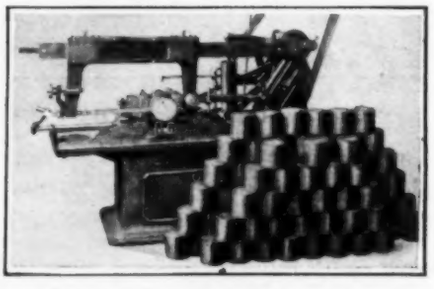
hole at the same time that a different machining operation is being performed.

The units are also designed to be attached to the tables of regular Avey drilling machines.

Atkins "Silver-Steel" Saw Blades

"Silver-steel" saw blades have been put on the market by E. C. Atkins & Co., Inc., Indianapolis, Ind. They are made of a heat-treated steel, which is the result of experiment for some time past.

The blades are priced at five times the prevailing cost of the present commercial quality, but are guaranteed to last six times as long and to cut from 50 to 100 per cent faster



Atkins "Silver-Steel" Saw Blades

than the ordinary blade. The illustration shows one of the saws in position in an Atkins No. 18 Kwik-Kut machine with a pile of work pieces which it has cut off. The saw was operated on this run at 80 strokes per min. The blade used was 18 in. in length by 1 in. wide by 0.065 in. in thickness and was cut with 6 teeth per inch. Eighty cuts were made in times ranging between 15 and 17 min., at the conclusion of which the saw was said to be in good condition.

The teeth are milled and are set exactly even on both sides of the blade. A heat-treatment is applied which is said to result in uniform quality for quantities of blades.

News of the Week

American People Have Little Cause to Complain of Economic Conditions

Secretary Hoover reviews business in 1924

Reviewing business conditions during 1924, Secretary of Commerce Hoover, in the foreword of the new COMMERCE YEARBOOK, issued July 15, says in part:

"The American people have little right to complain about our economic situation during the year 1924. Even agriculture has shown some partial recovery from its three years of extreme difficulty. Our industrial production was only about 5 per cent less than in 1923, which was the record year in the history of the nation, but was 13 per cent greater than in 1919. There was practically no unemployment in a distressing sense, the midsummer decrease in activity showing itself to a considerable extent in part time work. There was no boom under way in 1923, and therefore the minor decrease in production in 1924 was the result of a very short recession during the spring and summer months.

"Transportation showed increasing efficiency and its very efficiency has resulted in a mild revolution in distribution of goods. Under assured delivery, long advance orders to manufacturers are becoming less in volume, thus tending to reduce the capital invested in current national stocks of goods and consequently the cost of distribution.

"Building and other construction in 1924 showed an even larger volume than in 1923, registering the highest total in our history. While it seems that the construction shortage resulting from suspension during the war should be overtaken by this time, yet the rising standards of living are demanding improvement in housing and office conditions which maintain the industry at a high pitch.

"The shipping industry shows some improvement in 1924, although it has not yet reached a basis of stability. The textile industries experienced more inactivity than other manufacturing industries. The bituminous coal industry is in great difficulties due to complex causes, partly the hold-over from excessive expansion during the war. But generally we have but few difficulties remaining which can be attributed to the effect of the war.

"Agriculture has been blessed with a shift in prices for the better, probably in a large way at least reflecting the fact that while the number of farmers in the United States has remained constant since 1914, the consumers have increased greatly. Wheat prices were no doubt helped by the subnormal crops abroad and corn prices by crop failures in certain States. By and large, the average price of all agricultural produce now approximates the general level of commodity prices. Some farm products, particularly cattle, are still below the normal relationship with other commodities, but the shift is constantly in the direction of equality and gives hope for still better conditions for agriculture.

"Our foreign trade for the year shows an increase over 1923 of 10 per cent in exports at $4,591,000,000 and a decrease of 5 per cent in imports at $3,611,000,000. The most permanently significant change in our export movement was an increase of 7½ per cent in manufactured goods as compared with the previous year. Our merchandise exports exceeded our imports by $980,000,000.

"The foreign economic situation still affects our international trade relations markedly, as indicated by the above movements during the year 1924. But greater stability has been attained in Europe, due to the at least temporary settlement of reparations and especially to the more successful efforts of many countries at balancing of budgets and stabilization of their currencies.

"The publication by the Department of Commerce of the results of the exhaustive manufactures census taken for the year 1923 brings out vividly the rapid progress in industrial efficiency and in elimination of economic waste during recent years. The figures for 1923 when reduced to a quantitative basis (in order to avoid the effect of decreased purchasing power of the dollar) show that our manufacturing output has increased by fully 60 per cent over that of 1914. It also shows a very substantial gain over 1919. Against this large increase in products the number of wage earners increased by only 25 per cent as between 1914 and 1923, and it is interesting to note that the horsepower used increased 50 per cent in the same period. Wages for 1923 and 1924 were generally maintained at about 100 per cent higher than in 1913 and with the cost of living on a basis of about 70 per cent over the pre-war level our labor is receiving a large share of the result of this increased efficiency in the highest real wages of our history. The higher real wage has been expressed both in advancing standards of living and in greater savings on the part of the masses of the population.

"All together, as I have said, the American people have no great complaint over economic trends in 1924."

Italy Buys American Machine Tools

American exports of industrial machinery to Italy, as indicated by United States customs returns for the year 1924, show a gain of 70 per cent in comparison with 1923 and over 160 per cent when compared with 1922. This increase of American sales in Italy is especially encouraging because practically every European country of importance has been making vigorous efforts to regain trade lost by the war. This has made competition in Italy very keen and certain factors, exchange conditions, propinquity, and close acquaintance, have combined to the distinct advantage of such countries as Germany and France. The trade of the United States with Italy in machinery in the last two years has been a proof that American machine equipment can be marketed successfully under highly competitive conditions on the basis of quality, in spite of lower prices and long term credits offered by foreign dealers.

American exports of machine tools and other metal-working machinery to Italy amounted to $82,157 in 1922, to $142,263 in 1923, and to $304,376 in 1924. A gain of well over 100 per cent is represented in 1924 in comparison with the preceeding year. The sharpening and grinding machinery market is especially active and demand is growing for American equipment of this type. Lathes, milling machines, gear cutters, pneumatic portable tools, and screw machines of American manufacture found a heightened demand last year in comparison with 1923.

Navy Orders New Type Airplane

A contract for a new design of three-purpose airplane, for scouting, bombing and torpedo dropping, powered with two 400-hp. air-cooled engines, was awarded to the Douglas Co., of Santa Monica, Cal., by the Navy Department on July 8. This plane is a variation of the "SC" three-purpose type now in quantity production for the Navy. The twin-engined plane, to be known as the "T-2-D" is convertible for use either as a landplane or as a twin-float seaplane.

This experimental development is another step in the fulfillment of a Naval aircraft policy to produce multiple-purpose types of airplanes for use with the fleet.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

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AT the beginning of last week the Federal Reserve Board issued what was plainly intended to be a cautionary statement. It pointed out that a "gold outflow" of $175,000,000 had taken place in the last seven months and that the commercial banks are today in a position that is in startling contrast to the one they have held almost continuously since the end of the war.

"For four years prior to 1925," the Reserve Board says, "continuous imports of gold had been the principal factor in the large growth of commercial bank credit and the decreased use of Reserve Bank credit. But recently the direction of the gold movement has been reserved and gold exports have tended to check the growth of member bank credit and to increase the demand for Reserve Bank credit."

Attention is also called to the fact that the total of the loans and investments of all the member banks is now about $2,500,000,000 greater than it was in the spring of 1924, that for two years the total of loans and investments has been above the high point reached in the fall of 1920, and that on April 6, 1925, the aggregate of loans and investments was $3,000,000,000 in excess of the maximum of 1920.

An analysis of this increase then follows, by which it is made clear that the gain in loans and investments is chiefly due to the increase in securities owned and the increase in loans secured by stocks and bonds, that the total of loans made for commercial purposes is $1,500,000,000 below that of 1920, and that of a total gain of more than $4,000,000,000 in loans and investments since the low record of 1922 about three-fourths is represented by the increase in the holdings of investments and of loans on securities.

The somewhat involved phraseology of the statement, which is quoted almost verbatim, apparently obscured its importance, for out of a dozen business men who were asked only one seemed to have appreciated its significance.

It is therefore pointed out that it seems intended to call attention to the large amount of bank credit that is now being used to carry securities either directly or by loans against them, and to suggest that a further increase in such loans and investments may be inadvisable. The fact that the stock market has ignored the warning thus implied does not diminish its importance, and old-fashioned folk who still believe that abundant bank credit is essential to a sustained bull movement in the security market will govern themselves accordingly.

While stocks are perhaps a little higher than they were a week ago, the activity has been somewhat factitious, and bonds have been distinctly quieter. This is not to say they are lower, but the demand is less eager, and dealers seem indisposed to stock up heavily. New securities having a par value of $1,817,000,000 were listed on the Stock Exchange during the first six months of 1925, and the supply of unlisted investments has also been greatly increased.

The general quietude of the markets is therefore normal, and while the normal volume of necessary business is passing, there is little or no speculative activity in any quarter.

In a widely published interview Henry Ford expresses great optimism in regard to the economic, political and social future of the United States, but it cannot be said that his views have made more than a fleeting impression in Wall Street. Wheat, corn and cotton were run up early in the week on talk of drought and hot winds, but they lost most of the advance later.

In this country the steel industry is somewhat quieter, but the demand for copper has been active and prices are up to 14¼ cents. Whether the advance is due to the advertisements published last week, or vice versa is an open question. Lumber is also moving freely at prices which show but little change. Wool is well sustained. The business in both cotton and woolen textiles is somewhat better, and from the shoe trade a more cheerful feeling is reported. Railroad traffic continues to run ahead of last year. So do bank clearings, and the fact that our merchandise imports in June equaled our exports is about the only statistical item that can be adversely construed.

In Europe the week was a waiting one. It is the vacation season there as here, and there have been no developments of importance. The "fluctuous franc" has been relatively steady. Lugubrious Britain continues to talk about her unemployed, but she is pushing for business nevertheless, and, while the situation in China is still disturbing, it is taken for granted that Japan, England and America will find a way to co-operate in re-establishing enough government to assure the uninterrupted continuance of business. This is, to tell the truth, about all that is hoped for until the national consciousness of China is so reawakened that she is able to govern herself.

Taken altogether the world presents a picture that is encouraging to the practical man who knows human nature and realizes that perfection is unattainable. But such men also understand that constant readjustment is necessary to meet conditions that are constantly changing and just now the wisest among them are keeping their affairs and their judgment in flexible shape.

What's Doing in Industry

The trend of machine tool and machinery business in July is favorable. The activity that started in June has continued and in most localities shows no signs of slowing up. The steady activity of general industry is reflected in the demand for machinery to increase production, and dealers see a future volume of business quite in excess of last year.

As has been the case in the past, the Mid-West leads in actual sales and inquiries. Detroit reports the best week so far this year, with automotive buyers demanding new and improved tools. Cincinnati reports more inquiries and new orders that indicate a healthy expansion of manufacturing. A substantial improvement is noted in Cleveland, while Milwaukee reports more business than in any other month this year. Chicago is quiet, but new inquiries forecast future business.

The South is waiting for the final figures on the cotton crop before going ahead with various industrial projects, while New York and Philadelphia both have enjoyed substantial business in the past ten days. Industrials are the best buyers, with automotives and railroads following in order.

General business conditions all over the country present a picture that is encouraging to the practical man who knows human nature and realizes that perfection is unattainable. Readjustment is necessary, and the wisest of men are keeping their affairs and their judgment in flexible shape.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Cleveland

The machine tool business in the Cleveland district showed a decided improvement in the past fortnight. Nearly all lines of this industry received a large volume of orders. The punch and shear division, which has been quiet for the past two months, has shown considerable activity. The automotive industries were the chief buyers.

An optimistic feeling for the future is prevalent. Manufacturers report sufficient orders to keep their plants busy for the next sixty days. Several large orders are to be consummated soon.

Reports obtained from leading machinery producers indicate that business for the first half of 1925 was from 50 to 60 per cent greater than the same period of 1924. An analysis of sales records shows that the general industrials lead in buying.

Chicago

The second week in July finds the Chicago machine tool market in a generally satisfactory condition. The seasonal falling off in orders, usually beginning this month, is materially less than in the last two years. Inquiries are reported by most dealers as unexpectedly numerous, from which it is deduced that this year's business during midsummer will be above the average.

The Chicago Board of Education is in the market for tools for the new tech schools, and representatives have been in the trade during the last week with a view to closing bids. A desultory business is still being done with some of the Western railroads.

Some manufacturers representatives in Chicago report their plants to be working at 100 per cent capacity; others from 75 to 90 per cent. Taken as a whole, the local machine tool situation is such that complaints of poor business are rare, the great majority of dealers find sales and inquiries much better than expected.

Philadelphia

A decided change for better business has taken place in the machinery and machine tool business in Philadelphia during the last two weeks. Heads of some of the largest industrial firms in the Philadelphia district reported a better outlook than has appeared in eight months.

Indications from correspondence are that the small tool business especially will feel the effects of increased activity. Manufacturers in this line report that stocks in the hands of jobbers and dealers have been diminished to such an extent that replenishments must soon be made, and inquiries from all sections of the country indicate that railroads soon will be ready to purchase.

In the machine tool line the larger manufacturers feel more encouraged this week than for some months. This feeling is based upon inquiries of a substantial nature which are reaching the offices of the larger companies from a well distributed area. Most of the plants are operating on increased schedules.

Detroit

Sales of machinery and machine tools in the Detroit district continue active in spite of a slight decline in production brought about by vacation schedules. Leaders in the machine tool field report sales as being steady, and not seemingly dependent upon production. Many of the automotive factories are preparing for the new models which are being announced almost daily and will continue to be presented to the public through August.

The first six months of this year showed sales in Detroit far ahead of the same period in 1924, and all representatives of machinery manufacturers here believe that the year as a whole will be much better than the previous one.

Packard, Cadillac and Wilson remain the largest buyers of machinery and tools. Packard's rejuvenation of the entire plant so as to provide for motor driven machines throughout has meant the expenditure of more than a million dollars. The Wilson Foundry and Machine Co., of Pontiac, is placing orders for some half million dollars' worth of machinery. Cadillac's new aluminum and brass foundry, iron foundry, and pattern shop have been practically completed.

Southern District

While dealers report machine tool and equipment sales in the Southeast still rather quiet, business the past two weeks has slightly exceeded that of the corresponding period last year, averaging 5 to 8 per cent better.

The outlook for the remainder of July does not seem to promise much improvement, the dealers state, but they are looking for more active business during August, and fairly good sales through the fall. Mill supplies have already begun to pick up a little, and with inquiries fairly active good business is in prospect. As a whole, indications at present are that July sales, including mill supplies, will run about 6 to 7 per cent better than the same month in 1924.

Service station business is still rather quiet, but some business is being reported in rebuilt or used tools, including lathes, drill presses, cylinder grinding machines and smaller tools.

Smaller shops continue to buy fairly well, and are inquiring more freely, though much of this business is in used or rebuilt equipment. Textile business is still quiet though considerable new mill construction is in progress; railroads improved a little in buying the past two weeks and are inquiring on a fairly active basis for heavier equipment.

The primary reason for a bright fall and winter outlook is the 8 per cent increase in cotton acreage, and the promise of a 14,000,000-bale yield. The price is firm around 24 to 25 cents, sufficient to insure growers a substantial profit. This is certain to mean a period of industrial activity over the whole South, and good supply, tool and equipment business.

Milwaukee

Encouragement is noticeable in opinions given by members of the machine tool industry concerning the business possibilities from now until the end of the year. Current sales are not of sizable volume, but they are running above the average of any month in the first half of the year.

This being an important center of the milling machine industry, it is encouraging to note that the number of men at work in such shops is the largest in at least a year's time, although the total is still below the peak of early 1923. Repair and replacement jobs, and the production of newly developed appliances for use with standard types in the hands of users has reached a high point. While this may be accepted as meaning a hesitating demand for new equipment and might therefore be regarded as detrimental rather than beneficial to the welfare of the industry in its effort to reach volume, nevertheless much comfort is found in the interest users are taking. It is confidently believed that this will eventually result in many sales of new machines; incidentally, it is furnishing the designers considerable information of value as to trends in design.

Contracts are about to be awarded for the construction of a municipal service building in Milwaukee, which will cost about $350,000 and furnish centralized machine shop service for all city equipment. While considerable of the shop apparatus will be derived from the present scattered repair shops, much new and used equipment will be purchased, especially of the heavier types. According to R. E. Stoelting, commissioner of public works, specifica-

tions are not yet ready, and it may be three months longer before steps are taken to obtain estimates and bids on various items.

Local manufacturers of automotive units, parts and equipment are among the active buyers of new equipment, although in no case is the individual purchase large.

Cincinnati

Continued improvement in business conditions during the past week is reported by practically all Cincinnati manufacturers of machine tools, and the same statement is made by retailers. Some manufacturers have added to their working forces, and these desire that the word be passed along to others that there is no surplus of skilled mechanics here, as had been erroneously reported.

Many of the sales of the past week have been for replacement, rather than for expansion, but nevertheless there is a general feeling that many users of machine tools who have sent in inquiries will soon buy with a view to increasing their output.

Orders and inquiries received come from all sections of the country, but the general experience is that in the past week the best demand has been from the Central-West.

Railroads are reported to be buying more freely, with an increased number of inquiries coming from this source. Sales to the automotive industries have increased and inquiries are still coming in. General machinists have been buying new equipment; and also have industrial plants in various lines where machine shops are necessary.

A feature of the past week has been the increased demand from abroad, sales being reported for export to Germany, Austria, France and England.

New England

Further improvement in three branches of the machine industry is revealed in a survey of business in the Connecticut section of the New England district. This is found in industries allied with the automotive trade, builders of machinery and contract manufacturers; in companies engaged in machinery building for the textile trade; and among special machinery manufacturers.

Automobile builders in Bridgeport continue to increase their working forces and production schedules are expanding. Parts contractors in Hartford are operating departments overtime to meet rush demands; and machinery builders in New Britain report being comfortably busy.

Continuance of big building operations is causing a demand for press equipment from hardware manufacturers, some of it being of the replacement variety and some for expansion. Demand for specially designed machinery is good.

New York

Steadiness best characterizes the local machine tool market during the past week. Two weeks ago orders far in excess of expectations were placed in this district, but this volume has not been maintained, although a very satisfactory business is being done by dealers.

Industrial activity in and around New York continues at capacity and this has provided much of the current call for new machinery and shop equipment. Railroads have also been in the market for heavy tools, and the export trade, particularly to Germany and Russia, has shown decided signs of awakening.

Orders placed in this market were not large, but were nevertheless of a satisfactory total to compare with previous weeks. The Otis Elevator Co. bought an order of double-spindle drilling machines; the Reading Co. placed an order for a four-motor ash pit crane, with full complement of buckets; the Pittsburgh Railways bought a 1,500-lb. steam hammer; the General Electric Co. ordered a 6-in. vertical shaper, and the New York Central Railroad bought a large geared-head lathe.

The second-hand market reports a slight increase in business, many buyers seeking certain types of machines for some special work in hand. Hardware and electrical equipment manufacturers have been inquiring for machines and several orders from these sources are expected this month.

Protest Against Repairs Made by Railroads

A formal protest has been filed with the Interstate Commerce Commission at Washington by several large industrial corporations, which condemns the policy of railroads building and repairing cars in their own shops. The brief intimated that the railroads are doing this repair work at a loss and asked that the commission dictate a new method of accounting whereby the real cost of operations could be shown.

On July 6 the commission met at its regular session and the following order was issued to all railroads under its jurisdiction: "That all common carriers by steam railway of Class I. . . . be, and they are hereby, directed to file with the secretary of the Interstate Commerce Commission within thirty days from date hereof, copies of any or all contracts or agreements, now in effect, entered into by any such common carrier with any construction or repair shops, other than their own, for the repair or rebuilding of any locomotive, car or other equipment used by any such common carrier in the service of transportation, and, hereafter, to file within ten days after execution copies of any and all like contracts or agreements hereafter made."

To Study Standardization

A. E. Foote, of the simplified practice staff of the Department of Commerce, will in a short time visit most of the countries of Europe to secure definite and comprehensive information as to just what has been done in the matter of standardization.

There is great lack of knowledge in this country as to just what has been accomplished by foreign manufacturers, and what lessons have been learned from standardization efforts made abroad.

Post Office to Award Air Mail Contracts

Announcement has been made by Postmaster General New that his department is sending to the various postmasters concerned copies of advertisements and blank forms for the purpose of inviting bids for the operation of eight contract air mail service routes. Bids will not be received for these routes after Sept. 15.

The eight routes are as follows:

Boston, Mass., by Hartford, Conn., to New York, N. Y., and return.

Chicago, Ill., by Indianapolis, Ind., Louisville, Ky., and Nashville, Tenn., to Birmingham, Ala., and return.

Chicago, Ill., by LaCrosse, Wis., to St. Paul and Minneapolis, Minn., and return.

Chicago, Ill., by Moline, Ill., St. Joseph and Kansas City, Mo., Wichita, Kansas, and Oklahoma City, Okla., to Dallas and Fort Worth, Texas, and return.

Chicago, Ill., by Springfield, Ill., to St. Louis, Mo., and return.

Elko, Nevada, by Boise, Idaho, to Pasco, Washington, and return.

Salt Lake City, Utah, by Las Vegas, Nevada, to Los Angeles, California, and return.

Seattle, Wash., by Portland, and Medford, Ore., Sacramento, San Francisco, Fresno, and Bakersfield, Calif., to Los Angeles, Calif., and return.

Additional routes will be advertised as fast as petitions are received and the feasibility of such additional routes decided upon.

August Tuechter Has Anniversary Dinner

The fortieth anniversary of August H. Tuechter's connection with the Cincinnati-Bickford Tool Co. was celebrated on July 13 at a dinner given to him by a group of friends and associates in the Business Men's Club, in Cincinnati. J. B. Doan, of the American Tool Works, officiated as master of ceremonies and there were brief speeches by the guests who included H. M. Norris, chief engineer of the Bickford company; T. M. Pullman, of London, England; Fred. A. Geier, of the Cincinnati Milling Machine Co.; B. B. Quillen, of the Cincinnati Planer Co.; Wm. T. S. Johnson, of the Bradford Machine Tool Co., and E. A. Muller, of the King Machine Tool Co.

Mr. Tuechter started with the concern as office boy, July 13, 1884, and he is now president of the corporation and the owner of its capital stock. After the dinner he was presented with a handsome traveling case.

Field Shop Exhibit

The National Machine Tool Builders' Association, the National Aeronautic Association and Franklin Institute will be guests of the Army Ordnance Association on Oct. 2, on the occasion of the annual meeting of the latter organization. For the special benefit of the tool builders the Ordnance Body will have an extensive exhibit of its field shop equipment of the type used on the firing line and that used further back.

Personals

DR. OTTO P. GEIER, of the Cincinnati Milling Machine Co., who was appointed the American representative on the Industrial Health Interchange Commission of the League of Nations, has returned from an extensive inspection trip through European factories. Dr. Geier reports that the standards of safety and sanitation in these factories are far below those in American plants.

RUEBEN FRANKEL, for many years connected with the Garvin Machine Co., as assistant to George K. Garvin, has become associated with John B. Stevens and Julius Goldsmith in carrying on the manufacture and sale of many of the machines and parts of the old Garvin line. Mr. Stevens and Mr. Goldsmith were both associated with the Garvin organization for upward of twenty-five years, and are thoroughly familiar with the products. Offices have been established at Spring and Lafayette Streets, in New York, and papers of incorporation have been filed.

A. E. R. TURNER has been appointed manager of sales in charge of the Cleveland office of the Niles-Bement-Pond Co., of New York. Mr. Turner was formerly in charge of the Canadian office of John Bertram, Ltd., at Walkerville, Canada.

GEORGE HUNHOLZ, chief engineer of the Wesselman-Bohrer Co., Gera-Zwötzen, Germany, sailed for Europe on July 13 after spending several weeks in the United States studying modern production methods at leading machine tools plants.

E. V. WENZEL has joined the sales force of the Marshall & Huschart Machinery Co., of Chicago. He will cover the Michigan territory. Mr. Wenzel was formerly associated with the Giddings & Lewis Manufacturing Co., and with the Norton Co.

B. F. HUESE, technical director for N. V. Kromhout Motoren Fabriek, Amsterdam, Holland, will arrive in the United States next month for the purpose of studying American machines and methods with a view to applying some of these methods in the contemplated expansion of his firm in the fall. Mr. Huese will remain in this country for about two months.

F. LEE NORTON has been elected president of the Belle City Manufacturing Co., Racine, Wis., to fill the vacancy caused by the death of John Reid, Jr. Mr. Norton retired several years ago but resumed active business a few months ago as general manager of the Belle City company when Mr. Reid was taken ill.

D. C. BRIGGS, formerly production manager for the Detroit Steel Products Co., has become general superintendent in charge of manufacturing activities for the American Forging and Socket Co., of Pontiac, Mich.

A. A. HELLER, treasurer and general manager of the International Oxygen Co., Newark, N. J., returned last week from an extensive trip abroad.

S. P. KINNEY has been appointed supervising metallurgist of the Bureau of Mines. He will have charge of the bureau's work on ferrous metallurgy. He will supervise the work being done at the Pittsburgh, Minneapolis and Tuscaloosa stations. C. V. Sims has been transferred from Seattle and has been placed in charge of the metallurgical section at the Pittsburgh station.

G. W. SHERIN, advertising manager of the American Bosch Magneto Corporation, of Springfield, Mass., has tendered his resignation, to become effective August first.

J. B. HOWARD has been appointed New England sales representative for the Ohio Electric and Controller Co., of Cleveland. Mr. Howard has established headquarters at 398 Newbury St., Boston, Mass.

F. L. PETERSON has resigned from the sales organization of the Hendey Machine Co., of Torrington, Conn., due to ill health. Mr. Peterson has been associated with the Hendey firm for twenty-six years, and for the past eleven years has been manager of the Chicago office.

CARL NERACHER has been appointed chief engineer of the Durant Motors Corporation, of Elizabeth, N. Y. Leo H. Robinson has been appointed his assistant.

E. V. WILLS has joined the Chicago office staff of the Eisemann Magneto Corporation. He was formerly asistant service manager of the automotive division of the Westinghouse Electric and Manufacturing Co.

IRVING H. TAYLOR has been appointed assistant chief of the automotive division of the Bureau of Foreign and Domestic Commerce. Mr. Taylor comes from Detroit, where he served in an executive capacity in the export department of the Dodge Motor Co.

HARRY D. MCKINNEY has been elected second vice-president and general sales manager of the Driver-Harris Co., Harrison, N. J. Mr. McKinney came to the Driver-Harris Co. in 1918 as district sales manager of the New England territory, in which capacity he served until 1920 when he was transferred to the Chicago sales office as manager. Prior to going with the Driver-Harris Co., Mr. McKinney was associated with the Westinghouse Electric and Manufacturing Co.

Business Items

The General Die Casting Co., of Reading, Pa., has purchased a plot of land of approximately three acres in the northwest section of Reading. The company recently completed a steel construction, fireproof factory unit for the production of die cast parts. This unit will form a portion of three units. The new building is equipped with automatic labor saving machinery of approved design. The plant is under the management of F. C. Morrison, vice-president and general manager. Mr. Morrison for the past twelve years was manager of the die casting division of the Light Manufacturing and Foundry Co., at Pottstown, Pa.

The Westinghouse Electric Co. of Japan, has been organized as a subsidiary of the Westinghouse Electric International Co. Guy E. Tripp has been elected chairman of the new organization. L. A. Osborne is president and E. D. Kilburn is vice-president.

The Waterbury Castings Co., of Waterbury, Conn., has been purchased by the J. L. Mott Iron Works, of Trenton, N. J. The Waterbury plant is especially equipped for the production of Diesel engine parts.

The Pittsburgh Gear and Machine Co., of Pittsburgh, has been appointed exclusive distributor in that district for the sale and manufacture of fabroil and textolite nonmetallic pinions, control of which is in the hands of the General Electric Co.

The National Machinery Co., of Tiffin, Ohio, announces its second exposition of forging machinery, to take place at the plant in Tiffin, Aug. 24, 25 and 26. A large variety of equipment will be shown in actual operation on unusual jobs.

A group of officials of the General Motors Corporation have gone to Europe to study the export market. They will visit some of the important automotive exhibits while abroad. The party includes Fred J. Fisher, Charles Fisher, John J. Rascob, Charles S. Mott, John L. Pratt, James Mooney and Alfred H. Swayne.

Obituaries

SAMUEL MORROW, president of the Phœnix Iron Works, Portland, Oregon, died at his home in Portland on June 29. Mr. Morrow was a pioneer in the iron working and machine building industry in the West.

ROY H. CHRIST, chief of the metallography department of the Bethlehem Steel Co., died on July 6. Mr. Christ was active in national engineering societies and was secretary of the Lehigh Valley Chapter of the American Society for Steel Treating.

LOUIS F. MASSA, vice-president of the A. D. Granger Co., of New York, machinery contractors, died at Englewood, N. J., on July 2. Mr. Massa had been associated with the development of steam turbines and electrical equipment for many years.

JEAN CANIVET, resident representative of the Compagnie Francaise Thomson-Houston, with offices in the International General Electric Co., at Schenectady, N. Y., died on July 10, the victim of a swimming accident. Mr. Canivet, who was born in France, had been resident representative of the French company at Schenectady since 1912. During the war he served with distinction in the aviation forces of France, being a lieutenant in the famous Lafayette Escadrille.

Pamphlets Received

Choosing the Right Belt. Published by the Chas. A. Schieren Co., New York, N. Y. Describes the physical characteristics of good belting and relates the experiments and results of tests made at Cornell university. The factors to be taken into consideration in choosing a belt are listed as well as the reasons for their importance.

Simplified Practice for Plow Bolts. Published by the Bureau of Standards, Washington, D. C. Elimination of Waste, paper No. 23. Contains the "simplified practice" list of types and sizes of plow bolts as adopted unanimously on Feb. 20, 1924, by the general conference of manufacturers, distributors and users of plow bolts.

Regrinding of Machine Knives. Published by the Norton Co., Worcester, Mass. This little booklet goes quite thoroughly into the causes of trouble in the grinding of machine knives and their correction. The subject is divided into five parts: 1. Hardness of the grinding wheel; 2. Method of dressing; 3. Wheel speed; 4 Rate of feed and speed of traverse; and 5. Coolant or lubricant.

Methods of Compensation, No. 3. Published by the Metropolitan Life Insurance Co. A discussion of the methods of paying factory workers, of the group payment plan vs. the individual piece rate systems, and of the experience of the Packard Motor Car Co., the Hudson Motor Car Co., and other large organizations.

Forthcoming Meetings

American Railway Tool Foremen's Association. Annual convention, Hotel Sherman, Chicago, Ill., Sept. 2, 3 and 4. G. G. Macina, C. M. & St. P. Ry., 1402 Calumet Ave., Chicago, Ill.

International Railway General Foremen's Association. Annual convention, Hotel Sherman, Chicago, Sept. 8, 9, 10 and 11. William Hall, secretary and treasurer, 1061 W. Wabash St., Winona, Minn.

New Haven Branch of the American Society of Mechanical Engineers. Fifth annual machine tool exhibition. Sept. 8 to 11. Mason Laboratory. H. R. Westcott, chairman.

Association of Railway Supply Men. Annual convention and exhibition. Hotel Sherman, Chicago, Sept. 8, 9, 10 and 11. Earl E. Thulin, secretary, the Duff Manufacturing Co., 715 People's Gas Bldg., Chicago.

American Society for Steel Treating. Annual Convention and National Steel Exposition. Public Auditorium, Cleveland, Ohio. Week of Sept. 14. W. H. Eisenman, Secretary, 4600 Prospect Ave., Cleveland, Ohio.

Production Meeting Society of Automotive Engineers. Sept. 14, 15 and 16. In conjunction with American Society for Steel Treating. John Younger, chairman; C. F. Clarkson, secretary, 29 West 39th St., New York City.

National Safety Council. Fourteenth annual safety congress, Cleveland, Sept. 28 to Oct. 2. A. A. Mowbray, director, 168 N. Michigan Ave., Chicago.

Motor and Accessory Manufacturers' Association. Fall meeting, Prince Edward Hotel, Montreal, Canada, Oct. 14 to 16. M. L. Heminway, general manager, 250 West 57th St., New York.

National Industrial Advertisers' Association. Annual meeting, Chalfonte-Haddon Hall Hotel, Atlantic City, N. J., Oct. 19 to 21. W. A. Wolff, chairman, the Western Electric Co., 195 Broadway, New York.

Management Week. Conducted jointly by five societies—The American Society of Mechanical Engineers, The American Management Association, The National Association of Cost Accountants, The Taylor Society and the Society of Industrial Engineers. Week of Oct. 19 to 24. W. L. Conrad, of the A. S. M. E., is chairman of the joint committee.

American Welding Society. Exposition of welding equipment and accessories, Massachusetts Institute of Technology, Cambridge, Mass., Oct. 21, 22 and 23. R. L. Browne, chairman, 141 Milk St., Boston, Mass.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—The iron and steel market seems to have developed a firmer tone during the past week. Hand-to-mouth buying continues to be the general policy. The steel items showing greatest price firmness are sheets, tin plate, steel bars and tubular goods. The scrap market is inactive but does not show any weakness. Quotations on the principal heavy-rolled products are about the same. Bars are $2 per 100 lb.; shapes $2 and plates $1.90 at Pittsburgh mills.

Non-Ferrous Materials—This market has developed a much firmer condition and prices have advanced since last week. Old metals have steadily maintained a strong attitude and prices have advanced in many cases (copper, brass) although the demand is slight. Linseed oil advanced 3c. per gallon in New York.

(All prices as of July 17)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$23.05
Northern Basic	22.27
Southern Ohio No. 2	22.77
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	27.37
BIRMINGHAM	
No. 2 Foundry	19.00@22.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	23.26
Virginia No. 2	29.17
Basic	22.26
Grey Forge	22.75
CHICAGO	
No. 2 Foundry local	22.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	25.55
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	22.77
Basic	22.77
Bessemer	22.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.75
Cleveland	4.75@5.00
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.25@2.30	3.89	3.10	3.50
No. 12	2.30@2.35	3.94	3.15	3.55
No. 14	2.35@2.40	3.99	3.20	3.60
No. 16	2.45@2.50	4.09	3.35	3.70
Black				
Nos. 17 to 21	2.90@3.00	4.15	3.70	3.80
Nos. 22 to 24	2.95@3.05	4.20	3.75	3.85
Nos. 25 and 26	3.00@3.10	4.25	4.00	3.90
No. 28	3.10@3.20	4.35	4.10	4.00
Galvanized				
Nos. 10 and 11	3.15@3.25	4.35	4.10	4.00
Nos. 12 to 14	3.25@3.35	4.45	4.20	4.10
No. 16	3.40@3.50	4.60	4.35	....
Nos. 17 to 21	3.55@3.65	4.75	4.50	4.40
Nos. 22 to 24	3.70@3.80	4.90	4.65	4.55
No. 26	3.85@3.95	5.05	4.80	4.70
No. 28	4.15@4.25	5.35	5.10	5.00

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
3½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%, less 5%; class A, plus 23%. Cast iron, standard sizes, 36% off.

Size, Inches	List Price per Foot	Diameters Inches External	Diameters Inches Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ¼-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
¼	$0.09	50%	⅞	$0.16	35%
⅜	.11	45%	1	.18	31%
½	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	....	4.65
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	7.00	8.00	7.20
Hoop steel	4.49	3.85	4.15
Cold rolled strip steel	6.35	8.25	6.80
Floor plates	5.55	5.60	5.50
Cold drawn shafting or screw	4.15	3.80	3.60
Cold drawn flats, squares	4.65	4.30	4.10
Structural shapes (base)	3.34	3.20	3.10
Soft steel bars (base)	3.24	3.10	3.00
Soft steel bar shapes (base)	3.24	3.11	3.10
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.40	3.10
Bar iron (3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	60%	55%	60%

Electric welding wire, New York, 3/32, 8.25c.; ⅛, 7.85c.; 3/32 to ⅛, 7.35c. per lb. Chicago, 3/32, 8.85c.; 5/32, 7¾c.; ⅛, 7.95c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.85@15.00		
Tin, 5-ton lots, New York	59.00		
Lead (up to carlots) E. St. Louis	7.70	New York	8.75
Zinc (up to carlots) E. St. Louis	7.05	New York	8.00@9.50

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	18.50	21.50	....
Copper sheets, base	21.75	21.75	22.00
Copper wire, base	19.25	16.00	20.00
Copper bars, base	20.87½	20.75	22.50
Copper tubing, base	23.75	24.75	24.00
Brass sheets, base	18.12½	18.62½	18.37½
Brass tubing, base	22.75	25.25	26.00
Brass rods, base	15.87½	16.37½	18.37½
Brass wire, base	18.62½	20.12½	20.00

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1-15 ton lots	28.00	28.00	27.00
Zinc sheets (casks)	11.25	11.25	11.37
Solder (½ and ½), (case lots)	39.50	37.50	.....
Babbitt metal (83% tin)	60.00	67.50	50.00
Babbitt metal (35% tin)	28.00	20.50	28.00
Nickel (ingots) f.o.b. refinery	31.00	.....	.....
Nickel (electrolytic) f.o.b. refinery	38.00	.....	.....
Nickel (shot) f.o.b. refinery	32.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00
Manganese nickel hot rolled rods "E"—low manganese (base)	54.00
Manganese nickel hot rolled rods "D"—high manganese (base)	57.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00
Cold rolled sheets (base)			50.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	11.75@12.00	11.25	11.25
Copper, heavy, and wire	11.50@11.75	11.00	10.50@11.00
Copper, light, and bottoms	10.25@10.50	9.00	9.00@9.50
Heavy lead	6.00@6.25	6.25	6.25@6.75
Tea lead	5.00@5.25	3.75	5.25@5.75
Brass, heavy, yellow	7.75@8.00	6.50	6.75@7.25
Brass, heavy, red	9.25@9.50	8.75	8.00@8.50
Brass, light	6.50@6.75	5.50	6.00@6.50
No. 1 yellow rod turnings	8.00@8.50	7.00	5.00
Zinc	4.25@4.75	3.50	4.25@4.50

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$11.25	$11.45	$11.00
"A" Grade:				
IC,	14x20	8.85	9.40	8.50
	Coke Plates—Primes.			
100-lb.,	14x20	6.50	6.10	6.50
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	7.25	6.95	6.75

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.15@0.22	$0.19	$0.18
Cotton waste, colored, per lb.	.10@.15½	.18	.17
Wiping cloths, 13½x13½, per lb	.17@.17¼	36.00 per M	.11*
Wiping cloths, 13½x20½, per lb.	.....	45.00 per M	.11*
Sal soda, per 100 lb. keg	2.25	2.25	2.00
Roll sulphur, per 100 lb. keg	3.75	3.75	2.85
Linseed oil, per gal., 5 bbl. lots	1.04	1.16	.99@1.02
Lard cutting oil, 25% lard, per gal.	.55	.50	.32
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.35	.35	.21
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	30–10%	30–10%	30–10%
Heavy grade	20–5%	20–5%	20–5%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50–5%	50–10%	60%
Second grade	50–10–5%	60–5%	65%

*White, at washery.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0334
Cold finished shafting	per lb.	.0415	.0415	.044
Brass rods	per lb	.1587½	.1587½	.14
Solder (½ and ½)	per lb.	.395	.395	.3375
Cotton waste	per lb.	.15@.22	.15@.22	14@21
Washers, cast iron (½ in.)	per 100 lb.	7.00	7.00	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.38
Lard cutting oil	per gal.	.55	.55	.55
Machine oil	per gal.	.35	.35	.29
Belting, leather, medium	off list	30–10%	30–10%	40–2½%
Machine bolts up to 1x30 in.	off list	40%	40%	50%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.46	$5.84	$5.00
Emery paper	10.71	11.00	11.90
Emery cloth	29.48	31.12	32.75
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.45
Cloth	3.55	2.67	3.55
Fire clay, per 100 lb. bag	.....	.65	.75
Coke, prompt furnace, Connellsville	per net ton		2.85@3.00
Coke, prompt foundry, Connellsville	per net ton		3.75@4.25
White lead, dry or in oil	100 lb. kegs		New York, 15.75
Red lead, dry	100 lb. kegs		New York, 15.75
Red lead, in oil	100 lb. kegs		New York, 17.25

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1¼ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%. Machine bolts, up to 1x30-in., with cold punched and hot-pressed hex. nuts, also button head bolts with hex. nuts are $3.60@3.75 per 100 lb. at Cleveland.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x$\frac{5}{16}$-in., $2.25 per 100, less 40%.

Tap bolts, 1½x¼-in., $1.00 per 100. List plus 35% at New York warehouses; with hex. heads, $4.65 per 100 lb. net at Chicago.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ½x¼-in., 2c. each. Discount 70% for $\frac{5}{16}$-in. and smaller and 65% for ⅜-in. and larger.
Case hardened ½x¼-in., 6c. each, less 50%.

Rivets, button heads, ¾-in., ⅞-in., 1-in. diam. x2$\frac{1}{16}$-in. to 4½-in., $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{7}{16}$x1-in. and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb. for 1½ to 2-in. long, all diameters, 25c.; ⅝-in. dia., 35c.; ½-in. dia., 75c.; 1-in. long and shorter, 75c., longer than 5-in., 50c.; less than 200 lb., 50c.; countersunk heads, 45c.

Washers, cast iron, ½-in., $7.00* per 100 lb. at New York warehouses; ⅝-in., $6.00* per 100 lb.

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Conn., Hartford—Connecticut Co., West Main St., Waterbury—miscellaneous garage tools.

Mass., Chelsea (Boston P. O.)—Francis & Badger Motor Co., 297 Broadway—miscellaneous tools and equipment for repair and service garage.

N. J., Newark — Leiman Bros., 175 Christie St.—28-in. Bullard vertical boring mill.

N. Y., Woodhaven (Br. Jamaica) — H. Williams, 8425 85th St.—one 36 or 42 in. squaring shear.

O., Cleveland—One 10 ton crane.

O., Columbus—Columbus Auto Wrecking & Parts Co., 1390 West Broad St., J. B. Renner, Mgr.—18 in. lathe; grinding machine; automatic machine; large drill press.

O., Columbus — Continental Lumber & Supply Co., 632 Galloway Ave., R. Briggs, Gen. Mgr. and Treas.—woodworking machinery.

Pa., Erie—Bd. of Education, R. S. Scobell, Business Mgr.—manual training equipment for Wilson Junior High School.

Pa., Williamsport—Bd. of Education, H. A. Sterner, Secy., 229 West 3rd St., will receive bids until Aug. 4 for one 12 in. 4 ft. lathe, motor driven, 220 v., 2 ph., 60 cyc., with starting switch; 1 back geared shaper, motor driven, 220 v., 2 ph., 60 cyc.

Wis., Dorchester—Buehrens Tin Shop—30 in. grooving machine.

Wis., Port Washington—Port Washington Pattern Works, A. Kuhn, Pur. Agt.—36 in. band saw; small turning lathe; planer; joiner.

N. S., Windsor — Windsor Foundry & Machine Co., Ltd., T. Mounce, Pur. Agt.—equipment for foundry and machine shop, also forge.

Ont., Toronto — Burger Manufacturing Co., 25 Brant St.—equipment for manufacture of art metal goods, for proposed factory at Buffalo, N. Y.

Que., Chicoritini—A. Hemblay—complete saw mill equipment.

Que., Chicoutimi — Gauthier & Frere, vertical post drill, lathe.

Que., Chicoutimi—J. Levesque, Rue Price—grinder and tool room lathe.

Que., Kenogami—N. Riverin, 2 Chabat St.—saw table, buzz planer.

Que., Lachine—J. A. Dragon, 7th Ave.—12 or 16 in. buzz planer, saw bench.

Que., Montreal—Dulvis & Goiselin, Ltd., Rouen St. (sash and door)—band saw machine, probably 30 in.

Que., Montreal—M. Kiely, 243 William St.—upright drill, planer.

Que., Montreal—N. Metros, 135 Clarke St. (cabinet maker)—cabinet planer, shaper, etc.

Que., Montreal—Perreault Registered, 39 Azlurn St.—sticker and planer for woodworking.

Que., Montreal — J. E. Rockow, 1150 Bellechauert St. (sash and doors) — doweller, moulder, panel raiser.

Que., Montreal—V. Varin, 225 Moreau St.—mortised and band saw.

—Que., Quebec City — O. Chalifour, 126 Prince Edward St.—swing cut off saw, drum saw, shingle saw.

Que., Quebec City—Napoleon Gijnac Inc., 68 Lalemant St.—mortiser and planer.

Que., Quebec City—J. E. Larochelle, 119½ Richelieu St.—shaper, swing saw, etc.

Que., Quebec City — L. Lavole, 175 Du Pont St.—general equipment for garage and repair station.

Que., Vaudreuil — J. Bte. Juilet & Fils, Cascades Pointe—drag saw, self teed rip saw, etc.

Germany, Berlin — Thielicke & Co., Kaiser-Wilhelm Str. 2—machinery for the manufacture of motor cycles.

Opportunities for Future Business

Calif., Los Angeles—Cantell & Spencer, 6406½ Sunset Blvd., Archts. and Engrs., will build a 3 story, 80 x 196 ft. garage, on Cahuenga Ave. near Hollywood Blvd., for C. C. Hazelton. Estimated cost $150,000.

Calif., Sacramento—Sierra Mfg. Co., A. B. Reynolds, Ochsner Bldg., plans the construction of a factory for the manufacture of gas appliances, ranges, etc. Estimated cost $40,000.

Calif., Van Nuys—Van Nuys High School Dist., Los Angeles, is having plans prepared for the construction of a school including a 1 story manual arts building, etc. Estimated cost $165,000. O. H. Neher and H. Hasenberger, Insurance Exchange Bldg., Los Angeles, Archts.

Conn., Hartford—Connecticut Co., West Main St., Waterbury, will soon award contract for the construction of a 100 x 240 ft. repair shop and bus station. Estimated cost $150,000. R. W. Foote, 285 Church St., New Haven, Archt.

Conn., Hartford—State Police Headquarters, 100 Washington St., awarded contract for the construction of a 1 and 2 story, 55 x 145 ft. garage and repair shop on Washington St. Estimated cost $50,000.

Conn., New Haven—E. M. Jennings Co., 347 Crown St., awarded contract for the construction of a 98 x 285 ft. garage and repair shop, Whalley Ave. Estimated cost $150,000. Noted July 9.

Conn., New Haven — Von Beren Realty Co., c/o Brown & Von Beren, 185 Church St., Archts., awarded contract for the construction of a 3 story, 78 x 100 ft. garage, at High and Crown Sts. Estimated cost $150,000.

Conn., Waterbury—Patent Button Co., 41 Brown St., will soon award contract for the construction of a 4 story, 60 x 176 ft. plant on Abbott St. Estimated cost $200,000. Westcott & Mapes, 139 Orange St., New Haven, Archts.

Ga., Macon—Arnett Manufacturing Co. plans the construction of a woodworking plant for the manufacture of spool bobbins. Estimated cost $200,000.

Ill., Chicago—C. H. Hollup Corporation, 327 South La Salle St., awarded contract for the construction of a 1 story steel stock electric arc welding factory at South Turner Ave. and West 48th Pl. Estimated cost $40,000.

Mass., Boston—J. M. Howe, et al., 10 State St., is taking new bids for the construction of a 6 story, 140 x 160 ft. garage, at Cambridge and Greene Sts. Former bids rejected. $1,500,000. R. H. Doane, 162 Newbury St., Archt. Noted Mar. 12.

Mass., Lynn—General Electric Co. is receiving bids for the construction of a 1 story, 55 x 100 ft. forge shop building No. 42 E. Private plans.

Mass., Malden (Boston P. O.)—S. Spector, 24 York St., Dorchester, will build a 2 story, 110 x 225 ft. garage on Charles St., by day labor. Estimated cost $200,000. C. F. Springall, 50 Concord St., Archt. Noted June 11.

Mass., Waltham (Boston P. O.)—J. L. Thomson, Roberts St., awarded contract for the construction of a 3 story, 50 x 100 ft. extension to machine shop. Noted June 25.

Mass., Willimansett (Holyoke P. O.)—B. F. Perkins & Son, Inc., Holyoke, awarded contract for the construction of a 1 story machine shop with 40 ft. craneway, and a 2 story storage building here. Noted June 4.

Mich., Detroit—C. H. Acrane, 542 Griswold St., Archt., is taking bids for the construction of a 4 story, 100 x 100 ft. ramp garage on Woodward Ave. for D. Nederlanger, 11 Campus Martius. Estimated cost $150,000.

Minn., Minneapolis—Bd. of Educ., G. F. Womrath, supt., is receiving bids until July 31, for the construction of two 3 story schools, with manual training shops, at 42nd Ave. South and 24th St., and at 13th Ave. South and 24th St. Bureau of Buildings, Division of Design & Construction, engrs.

N. J., Newark—Reo Motor Car Co., 520 Broadway, plans the construction of a 2 story, 150 x 150 ft. sales and service building on Central Ave. $175,000. Fletcher-Thompson, Inc., 542 Fairfield Ave., Bridgeport, Conn., Archt.

N. Y., Buffalo—American Brass Co., 446 Military Rd., plans the construction of a nickel plating plant, on Military Rd., here. $15,000.

N. Y., Buffalo—Otis Elevator Co., 813 Northland Ave., plans the construction of a steel foundry on Northland Ave. Estimated cost $40,000.

N. Y., Ilion—Remington Typewriter Co., 374 Broadway, New York, awarded contract for the construction of a two 60 x 240 and 82 x 95 ft. additions to plant here. Noted June 11.

N. Y., New York—W. E. C. Draper, c/o Dennison & Hirons, Archts., 288 Lexington Ave., is having plans prepared for the construction of a 4 story, 100 x 150 ft. garage at 603 West 42nd St. Estimated cost $600,000.

O., Cleveland — Euclid-Ford Co., M. W. Bruml, Pres., Guardian Bldg., is having plans prepared for the construction of a 5 story, 150 x 210 ft. public garage, etc., at Euclid Ave. and Cornell Road. Estimated cost $300,000. M. Weis, 617 Union Bldg., Archt.

O., Columbus—E. A. Prentice Lumber Co., 449 North Park St., has had plans prepared for the construction of a 2 story, 20 x 60 ft. woodworking plant at 449 North Park St. Estimated cost $40,000. Private plans.

O., East Cleveland (Cleveland P. O.)—A. Green, 8914 Yale Ave., Cleveland, is receiving bids for the construction of a 1 story, 100 x 140 ft. garage on Elderwood Ave. here. Estimated cost $150,000. A. F. Janowitz, 811 Prospect Ave., Cleveland, Archt.

O., Youngstown—Youngstown Sheet & Tube Co., W. J. Morris, Wick Bldg., Treas., awarded contract for the construction of a seamless tube mill, here. Estimated cost $1,000,000. Noted Mar. 5.

Pa., Erie—Bd. of Education, R. S. Scobell, Business Mgr., will soon award contract for the construction of a 2 story, 188 x 279 ft. Wilson Junior High School. Estimated cost $400,000. W. W. Meyers, Archt., Mayer & Valentin, Plymouth Bldg., Cleveland, Consulting Engrs.

Pa., Philadelphia—J. Galbraith, 919 Commerce St., awarded contract for the construction of a 50 x 213 ft. box factory at 27th and Bainbridge Sts. Estimated cost $40,000.

Pa., Pittsburgh—Whitehill Gleason Motors, Inc., 250 South Euclid Ave., awarded contract for the construction of a 3 story, 127 x 150 ft. garage and sales building at Baum Blvd. and South Euclid St. Estimated cost $250,000. Noted May 14.

Tenn., Knoxville—D. M. Rose & Co. plans the construction of an 8,000 ft. per day capacity woodworking plant, first of 4 units, for plant addition. W. E. Biggs, Holston Bank Bldg., Consult. Engrs.

Tex., Dallas—L. F. Wilson, 2922 Swiss Ave., is having plans revised for the construction of a 2 story, 125 x 228 ft. garage at Pacific Ave. and Pearl St. Estimated cost $150,000. F. F. & C. F. Peterman, 1005 Mercantile Bank Bldg., Archts. Perry Motor Co., E. G. Perry, Gen. Mgr., 615 Good St., lessee.

Wash., Seattle—W. A. Meahan, c/o John Davis Co., 807 2nd St., having plans prepared 4 story, 120 x 120 ft. garage, 6th and Union Sts. Estimated cost $185,000.